TISCIA

Vol. XVII

ADJUVANTIBUS

I. BANCSI, I. FODOR, I. KISS, M. MARIÁN, L. MÓCZÁR,

M. OBRADOVIĆ

REDIGIT

GY. BODROGKÖZY

Index

SZEGED, 1982

TISCIA

Vol. XVII

DISSERTATIONES BIOLOGIAE A COLLEGIO EXPLORATORUM FLUMINIS TISCIAE EDITAE

ADJUVANTIBUS

I. BANCSI, I. FODOR, I. KISS, M. MARIÁN, L. MÓCZÁR, M. OBRADOVIĆ

REDIGIT

GY. BODROGKÖZY

SZEGED, 1982

ISSN 0563—586 X

Tiscia (Szeged) Vol. XVII, pp. 3—13 (1982)

OBJECTIVES AND RESULTS OF COMPLEX INVESTIGATIONS IN THE LANDSCAPE PROTECTION DISTRICT OF MÁRTÉLY (HUNGARY)

GY. BODROGKÖZY

Department of Botany, Attila József University, Szeged

(Received November 18, 1981)

Abstract

The research work on the natural conditions in the landscape protection district of the central part of the Great Hungarian Plain was started with geobotanical mapping in 1950. More extensive researches were launched in 1957, and later coordinated complex investigations followed from 1977. The results of this latter period will be reported now in Vol. XVII of Tiscia.

In the frame of the water quality program, the oxygen budget, salt dynamics, and the changes of organic load, while in the line of hydrobiology, first of all the dynamics of obligate and facultative fecal bacteria were investigated. The zooplankton studies were concentrated on the analysis of rotatorian fauna from the aspect of saprobiology. The seasonal investigation of phytoplankton revealed the increase of Euglenophytes in the eutrophyzed backwaters, therefore, these were qualified as indicator organisms.

In zoocenological respect, it could be stated that following the floods of the Tisza, the flood-plain is recolonized from external areas, which takes place in two steps. In the immigration phase, the initial increase of population is saturational, in the multiplication one it exhibits logistic growth. The observations were extended over some invertebrate groups, namely mollusks, butterflies and the family of Cerambycidae. Ichthyological ornithological and mammological investigations were also carried out.

In the frame of the phytocenological, synecological and ecological program, principally those changes were investigated which were caused by floods of different durations in the aquatic plant communities of the flood-plain, the marshy plant communities on alluvial soil, the plant communities of marshy meadows and mud weed vegetation. Correlation was sought between hese changes and other complex ecological effects.

Introduction

The ever increasing culture effects have produced enormous changes in the original features of the ancient landscape of the Tisza river. In the course of activities in the interest of satisfying the growing demand for arable land of the developing human society, the realm of marshy tracts of the Great Plain has disappeared. The regulation of the channel of the Tisza with short-cuts transformed and impoverished the biocenoses of groves and meadows in the flood basin. Thus, gradually, culture forests and plough fields began prevailing in this region, too. The rapid progress in economic field, however, cannot exclude the necessity resp. recognition of the urgent demand to protect, maintain and if possible reconstruct smaller or larger areas of a characteristic landscape and their original biota.

For the realization of that, a governmental regulation (No. 23 (1962) VI. 17) was issued to effectuate the Act of Environmental Protection passed in 1961 under No. 28. On the basis of the authorization contained in this regulation the 2.760 ha area in the region of Hódmezővásárhely was declared Landscape Protection District. This is the second area allocated to function as an open-air museum in our country.

The southern boundary of this district is the Sas-ér known principally for its bird reservation. It had been placed under protection earlier. To the east the area reaches its western boundary the line of the Tisza river along the Mártély backwater. The flood-plain inside the protecting dykes comprises diverse landscape sections despite the fact that a considerable part of the area had been planted with American poplar species and ash earlier, some 30—40 years ago. After the final utilization of these woods will start the reconstruction of the original oak-ash-elm groves and willow-poplar woods.

In the course of the regulation of the river, two holms formed in this area. These are surrounded by the Tisza itself and its backwaters. The less affected of the two is the Körtvélyes holm, while the Ányás holm is most exposed to culture effects.

Development and state of ecological conditions in the district

The compilation of general information in connection with this topic (Andó, Bodrogközy and Marián 1974) provides a very comprehensive survey both in theoretical and practical respects. According to this work, the more elevated parts of this area has been inhabited by man since the stone age. Several relics of prehistoric pottery have been recovered here. The finds from the bronze age are suggestive of an inhabitation of great number. For these inhabitants and the dwellers of following periods, the water-beaten areas of this region secured excellent natural protection. Notwithstanding, of the settlements formed here in the course of historic periods, only the village Mártély exists now (sketch map). Kórhány and Körtvélyes (Courtuleous by its old name) were destroyed. Such denominations as Lake Hattyas (inhabited by swans), Sas- (eagle-) brook, Lake Gémes (inhabited by herons), Keselyés- (-vulture) Brook etc: extant from the documents of the XII. century are indicative of a very rich ancient avifauna in the marshy tracts, reeds and fisheable water bodies of this region.

In this area, the erosion and sediment-formation of the Tisza has equalizingly affected the environment. In the flat parts in some places thinner or thicker sand layers were formed producing areas rich in various surface forms as river valleys, buried or filling backwaters and other water courses.

The developing of its biota can be traced back to several thousand years. The prehistoric animal remains of the middle reach of the Tisza refer to nearly 600 million years. Let us think of the evidences from the Pleistocene *Elephas primigenius, Rhinoceros antiqualis, Eurycesmegaceros, Alces alces* etc. The flora and fauna of this region transformed gradually by natural geographic changes can be followed up to the present day. It was, how-ever, the anthropogenic effects that have caused the greatest changes leading to the degradation and empoverishment of the environment. Nevertheless, we are in the lucky position of still having things to protect or reconstruct, and for this the necessary spiritual and financial foundations are secured. The research program executed in the valley of the Tisza and consequently also in our landscape protection district since 1950 serves for the realization of these objectives.

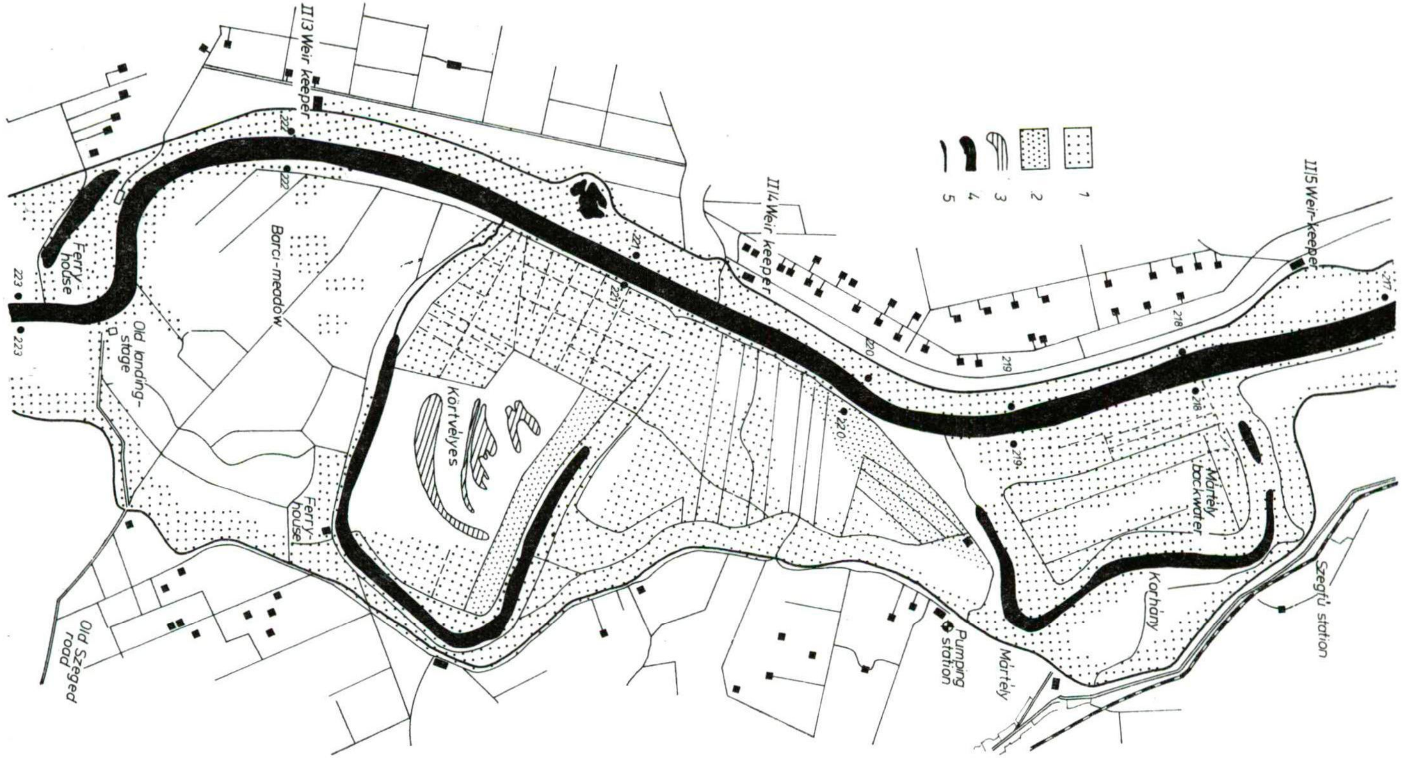


Fig. 1. Sketch map of the Landscape Protection District at Mártély. 1. Willow-poplar gallery forests and culture poplar forests in the flood-plain. — 2. Grape and fruit cultures perished on the effect of the lasting flood in 1970. — 3. Remainders of older backwaters. — 4. Younger backwaters. — 5. Protecting dyke (The boundary of the Landscape Protection District).

Brief survey of the results of the complex investigations in the district

The research works sponsored and supported by the Hungarian Academy of Sciences started with the mapping of the flora in the region of Szolnok and Szeged. From zoological point of view the ornithological studies in the Sas-brook area in this period deserve mention.

More extensive investigations in the various sections of the valley of the Tisza, particularly in the area of the landscape protection district, have been carried out since 1957. Several scientific and popular reports appeared from the field of natural geography, water chemistry, hydrobiology, botany resp. zoology. Excellent possibility for publication has been secured by our journal entitled Tiscia which has been published annually in foreign language since 1965.

Results of the last plan period

1. The hydrochemical program comprised principally the investigation of the changes of water quality in the Körtvélyes backwater. In the course of that studies on oxygen budget, salt dynamics, and the seasonal changes of pollution load were performed. These studies yielded valuable ecological information for the solutions of hydrobiological tasks. The changes of the chemical conditions of water were established and the processes of nutrient enrichment revealed. During these investigations allowance was made also for the flushing effect of the floods of the Tisza.

The results showed that compared with the conditions established in the previous plan period, the quality of water in the Körtvélyes backwater has not exhibited essential changes during the last four years. (In these studies the coworkers of the Directorate of Water Conservancy of the Lower Tisza Region participated.)

2. In the frame of hydrobiological studies, the hygienic bacteriological investigations were extended over the Mártély and Körtvélyes backwaters. On the basis of seasonal analyses conclusions could be drawn concerning the quantitative and qualitative relationships of obligate and facultative fecal indicator bacteria as well as the spatial and temporary changes of occasional bacterial pollution on the basis of 910 examinations on 202 samples. (Collaborators in these investigations were the members of the Tisza Research Team of the Station of Public Health and Epidemics of Csongrád Comitat.)

In the frame of zooplankton studies, sampling and processing of samples were performed continuously for 6 years. These investigations yielded new information in connection with the qualitative and quantitative seasonal changes of the food basis of fish in the backwaters. The results showed that species of Rotatoria dominated both in respect of species and individual numbers. They were found to have two maxima with values of 65 resp. 75 ind. 10 lit^{-1}. From saprobiological aspect, water quality deteriorated during summer because the beta- and alpha-mesosaprobic organisms increased in number parallel with the changes of hydrological properties (Collaborator in this work was one of the members of the Zoological Department of Attila József University, Szeged).

Phytoplankton. The algal flora of the backwaters of the Tisza at Mártély and Körtvélyes was investigated in several cycles. It could be stated that the water of both had become eutrophic. This pertains mainly to the backwater of Körtvélyes. Here, namely, the number of species belonging to Euglenophyta was relatively great and this is suggestive of the presence of fertilizing materials originating from external sources. The changes of the single algal communities were also studied. The presence or absence of some species namely were evidences that the particular algae are capable of utilizing not only mineral salts but also amino acids, carbohydrates, vitamins and plant hormones from the decomposing organic substances. This sould be also considered when establishing the indicator values for the single algal communities. Saprobity and trophity are connected not only by that the mineralization of organic materials causing saprobic conditions increase the degree of trophity but also by the ability of certain algal species to incorporate directly some of the organic materials. This partial heterotrophy can exhibit differences within one species, namely, there can be some kind of selectivity, as well.

In view of the above facts, it will be possible to form a more real and better judgement in connection with the role of algal species as indicator organisms in the field of biological water qulification as well as the food chain. (Collaborators in these investigations were the external coworker of the Department of Plant Physiology of Attila József University and our coworkers working at the Laboratory of the Directorate of Water Conservancy of the Lower Tisza Region.)

Zoocenological studies. The flood waves affecting the floodplain of the Tisza are at the same time the causes of the perturbation of epigeic animal communities. The catastrophe theory was used as model in its analysis. It could be stated that in the flood plain, the recolonization from external areas takes place in two steps. During the phase of immigration, the size of the initial population is of saturation type, in the phase of multiplication the growth of the original population is logistic. The possibilities for the shaping and the ratio of these two steps are the function of the migration bias of recolonizing populations and the strategy of growth of their propagulums. Namely, if we regard a flood as a typical ecological perturbation, then according to the scheme of "fold" catastrophe the following properties can be considered as ecological perturbation:

(a) Perturbation must be decreased to a level which is much smaller than the effect that causes dramatic changes in community structure at x_1 threshold value, to make it possible for the system to return to its original condition.

(b) Another threshold can also develop, from which there is no return to the positive range and this corresponds to irreversible perturbation. (Members of the Tisza Researches Team of the Zoological Department of the Attila József University participated in these studies.) Investigation of the cenoses of Mollusca in the flood-plain.

During the comparative studies of aquatic and terrestrial molluscs, their seasonal dynamisms was investigated from faunistical and ecological viewpoints. Evaluation of the species collected and identified from 21 sampling places pointed to the impoverishing of the terrestrial cenoses. Two factors gave grounds for that. Firstly, in the lower-lying parts of the flood-plain, the flushing through process of floods takes place often on 2—3 occasions during one year (Fig. 2). This is well indicated by the low values of diversity. On the other hand, there is perturbation of anthropogenic origin, too. Otherwise the composition of the molluscan communities of the original forest stands in the flood-plain correspond to those in the other parts of the valley of the Tisza.

In the Körtvélyes backwater, the survey of molluscan communities was performed in the light of the successional situations of the zonally arranged hydato- and helophytic communities (In these investigations the coworker of the Biological Department of Gy. Juhász Teachers Training College collaborated).

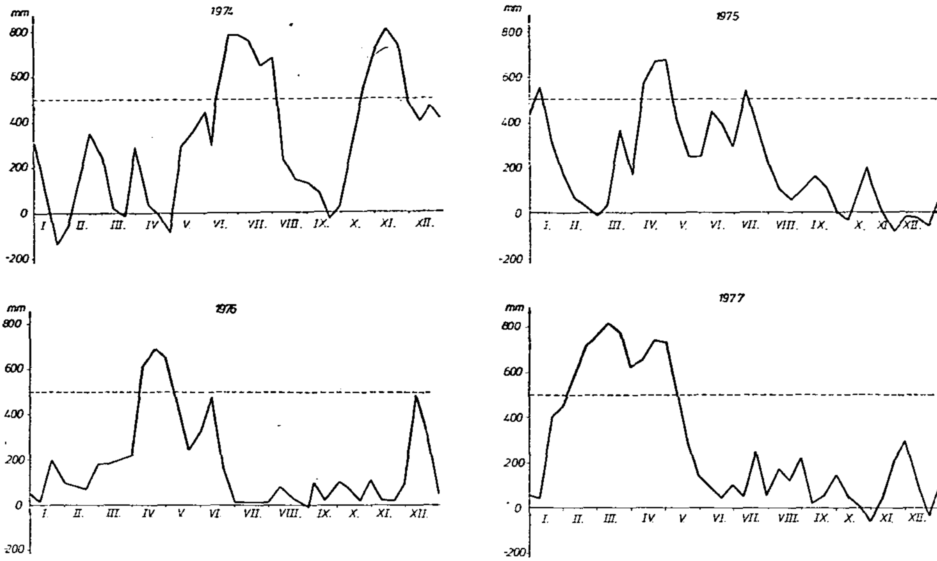


Fig. 2. Time and lastingness of floods in the area of the Landscape Protection District between 1974 and 1977. (The area was inundated at a water-gauge level above 500 mm)

As a result of the investigations on the butterfly fauna, we could report the occurrence of macro lepidopterans on the basis of specimens collected by various methods in the period between 1971 and 1980. The fauna list composed contains more than 2.600 captured and identified specimens. Parallel with that, comparison was made between the dominant species of materials collected by means of light-traps during one year at Mártély and those at Körtvélyes. The occurrence at Mártély of the rare owletmoth without zoo-geographical classification (Gorthyna borelli lunata (Pierret)) deserves mention here (The amateur lepidopterist of our working team collaborated in these investigations).

During studies on Cerambycidae the species of this family feeding on *Salix alba* were surveyed in the Körtvélyes holm from 1974 to 1980. 25 species with this food plant were identified. Most of them develop in brushwood. In connection with their ecological demands, it was stated that the conditions for the development of xylophagous species of Cerambycidae are critical in this area. In both the larval and the pupal stages of development, they are protected from flood, this protection is, however, far from being complete. The recurring high flood stage selects principally those species of Cerambycidae which live on dead *Salix* stems and cannot fly and for which several years are necessary to develop.

It was also stated that the phytoncydes of *Salix alba* represent an excluding factor for certain species. From practical point of view, monoculture-type *Salix alba* stands can be said as favourable, because these exempt the other planted culture forests from infections of such type.

Special mention should be made here of the rare *Molorchus salicola* (STILLER) and *Phymatodes puncticollis* (MULS.) found in this area (The biologist of F. Móra Museum collaborated in this work).

Ichthyology. The survey of fish species found in the backwaters of this area has been finished in the course of the last 4 years. In 1976 31, in 1981 29 fish species figured in the fauna list. The feeding habits and food composition of pike and pike-perch in the Tisza were cleared. These studies also provided information in connection with the effect produced by recurrent floods on fishes (Fig. 2). The spread of *Esox lucius* can be related to the more than one flood period during February and March, and the high individual numbers of *Albanus albanus* and *Rutilus rutilus* (In this work one of the teachers of the G. Dózsa Special Secondary School participated).

Ornithological studies in our area were carried out in several directions. The results of the analyses of the food samples from young (1-2-week-old) blue tit and tree-sparrow in the nesting box colony in the forests of Körtvélyes holm collected at 2 h intervals by means of ligular resp. neck-ringing methods may command special interest. Correlation was found between the percentual ratio of nesting box dwellers and the occurrence resp. absence of high-water period to the advantage of the former. — The survey of the avian fauna was also continued. Correlation was sought between the frequency of the floods of the Tisza and the nesting bird stand, resp. the qualitative and quantitative changes of bird migration. The share of Passeriformes stands in the circulation of materials and energy cycle of this area was demonstrated on the basis of the biomass of bird species (Participants in these studies were one research worker and the coworkers of Gy. Juhász Teachers Training College resp. F. Móra Museum).

The mammological studies were focussed principally on the effect of floods on the population of *Talpa europaea*. The observations were extended both over the flood-plain and the protecting dyke. It could be stated that in the soil under water cover the moles are unable to live. During flooding the protecting dyke secures protection for these animals. Regeneration can occur depending on several ecological factors and in different measure (Collaborator in this work was the mammologist of Gy. Juhász Teachers Training High School).

Phytocenology-synecology. Investigations in his line were performed in our landscape protection district for more than 10 years. The objectives of these studies were to analyze in detail the plant communities from phytocenological aspect and their phytomass production. The single associations were investigated from the aspects of environmental biology, soil ecology and hydroecology.

Results:

(a) The results showed that owing to the low geographic level of the area, its phytocenoses are quantitatively poorer than those in the other areas of the valley of the Tisza. The stands of hydatophytes in the backwaters of different ages were rather rich. The introduction of herbivorous silver carp, however, completely exterminated them. Now, after the fish have been caught, their return is in process. On the other hand, the meadow communities of helo- and hygrophytes in the flood plains are most diversified.

(b) Follow up studies in connection with the investigation of the phytomass production and seasonal changes of the three most frequent marshy meadow stands were performed for a number of years.

(c) The survey of changes occurring as a result of lasting water cover formed an independent topic. The stands of *Typhoides arundinacea* proved to be the most sensitive. — Other species were found to be sensitive to light. The shading effect of the *Populus alba* stands, especially in the north-west shade zone, was not tolerated by *Glycyrrhiza echinata,* and only in a small measure by *Lythrum salicaria*. This suggests from ecological point of view that light conditions are the most effective in the early morning hours.

(d) From synecological aspect one of the most important tasks was to determine the hydroecological adaptability of the species of the single associations. By working up the material collected during the phytocenological investigations along the Tisza river for 30 years (which was complemented with materials from other areas of our country) it was possible for us to further develop and complement the hydroecological system constructed by ELLENBERG and ZÓLYOMI et al.

References

ANDÓ, M. (1974): Regional ecological conditions of the Region-Conservation District at Mártély—Körtvélyes — T(Sz)+, Aek++ *9*, 159.

ANDÓ, M. (1975): Areal ecological conditions of the Region-Conservation District at Mártély—Körtvélyes. — T (Sz) Aek. *10*, 94—95.

ANDÓ, M., BODROGKÖZY, GY. and MARIÁN, M. (1974): A Mártély—Sasér Tájvédelmi Körzet társadalmi hasznosításának biológiai és természeti földrajzi alapjai pp. 1—103+120 melléklet (Kéziratos pályamű) (Biological and naturalgeographical bases for the social utilization of the Landscape Protection Area at Mártély—Sasér pp. 1—103+120 enclosures (Competition essay in manuscript) (in Hungarian).

BÁBA, K.: (1982): Comparative faunistic and oecological investigations into the land-mollushe of the Körtvélyes reservation area. — T(Sz) Aek. *17*.

BELICZAY, I. (1975): Reconstruction of the naturel conservation district Mártély. — T(Sz) *12*, 77—84.

BERETZK, P. (1962): A körtvélyesi Tisza-holtág tavasszal (The backwater of the Tisza at Körtvélyes in spring). — Term. Tud. Közlem. 163—165. (in Hungarian).

BODNÁR, B. (1928): Hódmezővásárhely és környékének régi vízrajza (The old hydrography of Hódmezővásárhely and its environment). — Szegedi Alföld L. Biz. Kiadv. Szeged (in Hungarian).

BODROGKÖZY, GY. (1973): Természetvédelem Csongrád megyében (Nature conservation in Csongrád County). — Csm. Tanács Term.-véd. Biz. Kiadv. Szeged *1*, (in Hungarian).

BODROGKÖZY, GY. and HORVÁTH, I. (1974): Production examinations on the hayfields of the Mártély—Körtvélyes Region-Conservation District. — T(Sz) *9*, 164—165.

BODROGKÖZY, GY. and HORVÁTH, I. (1977): Study of the indicator role of plant populations of marsh-meadows along the Tisza in the water-household of the inundation area at Körtvélyes. — T(Sz) *12*, 65—70.

BODROGKÖZY, GY. and HORVÁTH, I. (1978): Connection between stock-structure and organic matter production in the marshlands of the flood-plain at Körtvélyes. — T(Sz) Aek. *13*, 180.

BODROGKÖZY, GY. and HORVÁTH, I. (1979): Effect of lasting floods on the species composition and organic matter production of the marshy-meadow lands in the flood plains of the Tisza. — T(Sz) Aek. *14*, 87—88.

BUGYI, I., CSIZMAZIA, GY., GORZÓ, L., HAVRANEK, L. und KOLOSVÁRY, G. (1965): Weitere Untersuchungen über die Entwicklung der Fauna des Tisza-Tales. — T(Sz) *1*, 81—92.

CSIZMAZIA, GY. (1962): Die ökonomische Bedeutung der Karnivoren Vögel der Inundations-Wälder. — Acta Biol. Szeged.

CSIZMAZIA, GY. (1972): Adatok az emlősök biokorróziójához a Szeged környéki árvízvédelmi töltéseken az 1970. évi árvíz idején (Data to the biocorrosion of mammals on the protecting dyces in the environment od Szeged during the flood of 1970). — Alsó-Tiszavidéki nagy árvízvédekezés 1970. VIZDOK (In: Vol. entiled "Alsó-Tiszavidéki nagy árvízvédekezés" 1970).

CSIZMAZIA, GY. (1973): On the mammalian fauna of the Landscape Protection District of Mártély—Körtvélyes. — T(Sz) Aek. *8*, 8.

CSIZMAZIA, GY. (1980): A Tisza magyarországi hullámterén végzett mammalológiai-ökofaunisztikai vizsgálatok. I. (Mammological and ecofaunistical investigations in the flood-plain of the Hungarian section of the Tisza). — J. Gy. Tanárképző Főisk. Tud. Közlem. Szeged, 1980.

CSIZMZAIA, GY. (1974): The mammalian fauna of the Region-Conservation District at Mártély—Körtvélyes. — T(Sz) Aek. *9*, 168.

CSIZMAZIA, GY. (1975): Mammalian associations in the Region Conservation District at Mártély—Körtvélyes. — T(Sz) Aek. *10*, 100—101.

CSIZMAZIA, GY. (1978): A contribution to the behaviour of *Talpa europaea*, living in the flood plain, during the flood. — T(Sz) Aek. *13*, 210—211.
CSIZMAZIA, GY. (1982): Die Wirkung des Hochwassers der Theiss auf die Population der Maulwürge *(Talpa europaea* L.*)* im Inundationsraum bei Körtvélyes (Ungarn). — T(Sz) *17*.
DOBLER, L. MRS. and HEGEDÜS, M. (1978): Data on the water quality of the Tisza dead-arms in the Region Conservation District at Mártély—Sasér. — T(Sz) Aek. *13*, 177.
DOBLER L. MRS. and KOVÁCS, K. (1982): Biological waJer quality in the Mártély and Körtvélyes backwaters of the Tisza from 1976 to 1980, with special regard to phytoplankton changes. — T(Sz) Aek. *17*.
DOSZTÁL, I. (1975): Some data on water-bug species of the flood plains of the Dead-Tisza at Körtvélyes and the Double-Körös. — T(Sz) Aek. *10*, 106—107.
EGYED, B. (1979): Investigation of the problems of land use and environmental protection in the area of the Mártély Region of Scenery Protection. — (Thesis in Hungarian, submitted to the Univ. of Agric. Sci) Gödöllő.
FARKAS, Á. (1972): Jelentés a Tisza körtvélyesi holt ága halainak vizsgálatáról (Report on the investigation of the fish fauna in the backwater of the Tisza at Körtvélyes) (Manuscript) (in Hungarian).
FARKAS, Á. (1975): Pisces fauna of the Tisza dead-arm at Körtvélyes. — T(Sz) Aek. *10*.
FARKAS, Á. (1977a): Pisces fauna of the Tisza dead-arm.at Körtvélyes. — T(Sz) *12*, 101—108.
FARKAS, Á. (1977b): Ecological relations of fish stand of Körtvélyes dead-Tisza after the appearing of phytophagous fish. — Timely questions of fish greeding in natural waters in Hungary, Summaries 4.
FARKAS, Á. (1978): Experiences of the fish destruction at Körtvélyes the appearance of the herbivorous fishes and the ecological relations of their role. — T(Sz) Aek. *13*, 181—182.
FARKAS, Á. (1982): Ichtyological relations of Körtvélyes dead channel in Mártély landscape protection area. — T(Sz) *17*.
FÜGEDI, K. and HORVÁTH, M. (1982): Water quality in Körtvélyes backwater. — T(Sz) *17*.
GÁL, D. (1974): Zooplancton of the Dead-Tisza at Körtvélyes in 1972. — T(Sz) Aek. *9*, 165—166.
GÁL, D. (1978): Some characteristics of the zooplankton of the Tisza deas arm at Körtvélyes. — T(Sz) Aek. *13*, 179.
GÁL, D. (1982): Comparative zooplancton investigations in the dead reach of the river Tisza. — T(Sz) *17*.
GALLÉ, L., GYÖRFFY, GY. and HORNUNG, E. (1982): Flood as an ecological perturbation of epigeic animal communities. I. Some preliminary hypotheses on the application of catastrophe theory by evaluating some Mártély—Körtvélyes data. — T(Sz) *17*.
GASKÓ, B. (1979): Adatok a Szeged körtöltés melletti erdősáv Cerambicidai faunájához (Data to the Cerambycida fauna of the forest belt at the Szeged dyke. — Móra F. Múz. Évk. 1979.
GASKÓ, B. (1982): Cerambycid beetles developing on the willom Salix alba in Körtvélyes. — T(Sz) *17*.
HARKA, Á. (1972): The composition of fish stand in living Tisza. — Halászat *18*, 22—25. (in Hungarian).
HEGEDÜS, M., FODRÉ, ZS. and ZSIGÓ, M. (1980): Hygienic bacteriological investigations in the Tisza reaches between Csongrád and Szeged. — T(Sz) *15*, 35—44.
HEGEDÜS, M. and ZSIGÓ, M. (1982): Hygienic bacteriological investigations of the backwaters at Mártély and Körtvélyes. — T(Sz) *17*.
HORVÁTH, I. and BODROGKÖZY, GY. (1975): Connection between stockstructure and organic-matter production in the marshy meadows in the Tisza flood-plains at Körtvélyes. — T(Sz) Aek. *10*, 105—106.
HORVÁTH, I. and BODROGKÖZY, GY. (1977): The association conditions of the peat bogs in the flood-plain as a result of a lasing flood in the district of Körtvélyes. — T(Sz) Aek. *12*, 151.
KISS, I. (1976): Comparative algological investigation in to the dead arms of the Tisza at Mártély and Körtvélyes. — T(Sz) Aek. *10*, 150—151.
KISS, I. (1977a): Investigation of the water blooms of *Eudorina elegans* in the dead-arm of the Tisza at the community Mártély. — T(Sz) *12*, 37—48.
KISS, I. (1977b): Variability of *Scenedesmus ecornis* (RALFS/CHOD.) inthe dead-arm of the river Tisza at Körtvélyes. — T(Sz) *12*, 49—56.
KISS, I. (1977c): Comparative algological investigation into the dead arms of the Tisza at Mártély and Körtvélyes. — T(Sz) *12*, 150.
KISS, I. (1982): The algal flora and its seasonal asoects in the Körtvélyes and Mártély bacjwaters of the Tisza (Central Hungary). — T(Sz) *17*.
KOLOSVÁRY, G. (1966): Die Opilioniden des Reservates Sasér bei der Theiss. — T(Sz) *2*, 121.
KOVÁCS, S. T. (1982): Data to the knowledge of Lepidoptera fauna at Mártély—Körtvélyes, environment protection area. I. — T(Sz) *17*.

LÁNYI, B. (1915): Csongrád megye flórájának előmunkálatai (Preliminary studies on the flora of Csongrád County). — Magyar Bot. Lapok *13,* 232—274.
MAGYAR, L. (1977): The role of artificial nesting boxes in winter in the aspen plantation of the flood-plain of the Tisza-stretch at Körtvélyes. — T(Sz) Aek. *12,* 152.
MAGYAR, L. (1978): Nutrition biological investigations in the artificial nestringbox colony of the forests in the flood plain at Mártély—Körtvélyes, Paris farmstreat. — T(Sz) Aek. *13,* 200—201.
MAGYAR, L. (1982): Feeding ecological investigations in the district of the nature conservation-area Mártély—Körtvélyes. — T(Sz) *17.*
MARIÁN, M. (1963): A Közép-Tisza kétéltű és hüllő világa (Amphibians and reptilia of the middle section of the Tisza river). — Móra F. Múz. Évk. 207—231.
MARIÁN, M. and PUSKÁS, L. (1982): Ecological and quantitative relations of the bird community in the holm Körtvélyes. — T(Sz) *17.*
MÓCZÁR, L. and GYÖRFFY, GY. (1982): Quantitative and qualitative data on the flying insect communities on the Körtvélyes inundation area. — T(Sz) *17.*
POKOMÁNDY, GY. (1890): Hódmezővásárhely természeti leírása (Description of the nature at Hódmezővásárhely) (manuscript in Hungarian).
SZEREMLEI, S. (1900): Hódmezővásárhely története I—V. Kiadta a város közönsége.
STERBETZ, I. (1974): Die Vogelwelt der Reservate des Überschwemmungsgebietes der Theiss bei Hódmezővásárhely (in Hungarian). — Aquila 1971—1972, 45—79.
STERBETZ, I. (1977): The rook *(Corvus frugilegus* L.*)* (1758) in the nesting community of the heronry at Sasér. — T(Sz) *12,* 141—144.
STERBETZ, I. (1980): The flood basis of rooks *(Corvus frugilegus* L.*)* (1758) wintering in the nature reserve at Mártély and Sasér. — T(Sz) *15,* 125—130.
SZITÓ, A. (1974): Quantitative and qualitative study of Chironomida larvae on the section of the Tisza between Tiszafüred and Kisköre. T(Sz) *9,* 83—86.
TANÁCS L. (1975): The Apoideae of the dams of Mártély—Körtvélyes and Tiszasziget. — T(Sz) Aek. *10,* 107.
TANÁCS, L. (1979): Regeneration of the Apoidea insect fauna in the flood area, as a function of the ecological conditions. — T(Sz) *14,* 175—185.
TANÁCS, L. (1979): Protected areas of the flood plain of the Lower-Tisza region, theire Apoidea insect population and the connections of these with nutritive plants. — T(Sz) Aek. *14.*
UHERKOVICH, G. (1967): Über die Sommerplankton des Altwassers von Mártély. — T(Sz) *3,* 13—20.
Országos Természetvédelmi Tanács (1951): Határozat Sasér természetvédelmi területté nyilvánításáról (Decision declaring the Sasér a nature conservation area in Hungarian).
Országos Természetvédelmi Hivatal (1971): A mártélyi és hódmezővásárhelyi Tisza-hullámtér tájvédelmi körzetté nyilvánító határozata (Decision declaring the flood-plain sections of the Tisza at Mártélya and Hódmezővásárhely nature conservation areas) (manuscript in Hungarian).

A Mártélyi Tájvédelmi körzet komplex kutatási feladatai és eredményei

BODROGKÖZY GY.

A József Attila Tudományegyetem Növénytani Tanszéke
Szeged, Magyarország

Kivonat

A Magyar Alföld középső szakasz tájvédelmi körzetének kutatása 1950-ben vette kezdetét a szervezett vegetáció-térképezés megvalósulásával. A szélesebb alapokon nyugvó program 1957 óta, összehangolt komplex jellegű munkálatai 1977 óta folynak. Ezen utóbbi időszak eredményei a Tiscia XVII. kötetében látnak most napvilágot.

A hidrológiai program keretében a holt ágak vizének oxigénháztartásával, sódinamikájával, illetve szennyeződés mértékének változásával foglalkozunk. — Hidrobiológiai vonalon elsősorban az obligát- és fakultatív faecal baktériumok dinamikájára, zooplankton vonatkozásában főleg a Rotatoria fajok szaporodás-biológiai nézőpontból történő elemzésére terjedtek ki. — A fitoplankton szezonális változásának értékelésénél az eutrofizálódott holt ágak vizében az Euglenophytonok elszaporodása volt konstatálható s ezek indikátor szervezeteknek minősültek.

Zoocönozisai vonatkozásában megállapítható volt, hogy a Tisza áradásai után külső területekről történik a hullámtér rekolonizációja, mégpedig két lépcsőben. Az inmigrációs fázisban az iniciális populáció nagysága szaturációs. — A megfigyelések kiterjedtek a Mollusca cönozisok, továbbá a Lepidopthera, Cerambicida fajcsoportokra egyaránt. Folytak továbbá ictiológiai, ornithológiai és mammológiai vizsgálatok is.

A fitocönológiai-synökológiai produkcióbiológiai program főleg a hullámtér vízi-, öntéstalajú mocsári-, mocsárréti valamint iszapgyomnövény társulásokra összpontosult. Összefüggést keresve az eltérő időtartamú áradások és egyéb környezetbiológiai változások komplex jellegű hatásával is.

Tiscia (Szeged) Vol. XVII, pp. 15—27 (1982)

WATER QUALITY IN KÖRTVÉLYES BACKWATER

KLÁRA FÜGEDI and MÁRIA M. HORVÁTH

Directorate of Water Conservancy of the Lower Tisza Region, Szeged
Attila József University, Szeged
(Received Nov. 28, 1981)

Abstract

From the aspect of water chemistry, unequivocal increase resp. decrease was not found in the amounts of most components. The results suggest that the water quality has not changed essentially in the backwaters during the last three years.

Introduction

Increasingly more mention has been made recently of the importance of environmental protection and the urgentproblems of nature conservancy. We speak about natur econservancy and environmental protection separately as if the were different things. This differentiation is, however, faulty. There is no nature conservation without the examination of the environmental factor (PAPP 1973, 1974).

The protection of environment does not mean only water and air protection (SEBESTYÉN 1963). The task they have in common is the protection of our still existing natural resources and the saving of our rivers and forests that are partly on the brink of perdition, partly heavily polluted. The same purpose is served by the measures of the National Authority for Environment Protection and Nature Conservation as well as the Act of Environmental Protection. Building and reconstruction of land has been carried out in increasingly more places, but land conservation is above them in importance. It is always cheaper and simpler to preserve the natural conditions of a region than to sanify a ruined land (Publications of Kiskunság Nemzeti Park 1978, 1979, 1980) not to mention in this regard the difference in value between a natural land and an artificially shaped one. In our country there are also several nature conservation areas resp. land conservation districts. The Körtvélyes backwater, the object of these studies is also such an area.

Preliminaries

The flood-plain on the left shore of the Tisza in sections ranging from 1970. riv. km to 208.3 riv. km and from 33.0 riv. km to 46.0 riv. km were declared Land Conservation Area by decision No. 390/1971 of the National Authority for Environment Protection and Nature Conservation. In 1974, the Szeged Board of the Hungarian Academy of Sciences charged the Team of Tisza Research with the commission to work out the foundations for the social utilization of the Körtvélyes Land Conservation District. In 1976, the Directorate of Water Conservation of the Lower Tisza Region joined with the Team of Tisza Research of the Hungarian Academy of Sciences in the implementation of this work.

The origin of the backwater

The history of the land

Before the regulations of the water-ways in the last century, the rivers of the Hungarian Plain dominated over an area of approx 25 000 km^2 during high-water periods occurring once or twice in a year. The enormous damages caused by these floodings were radically eliminated by the regulation of the Tisza (1850—1932). In the course of this large-scale enterprise the 1214 km length of the Tisza river was shortened to 960 km by means of 112 cut-offs and the flood-plain limited to the narrow shorelines was pressed within a long dam system.

Considering the fact that this system of flood-control was established by techniques used in the last century under the unfavourable conditions of old days and with the toilsome work of pick-and-showel-men, we can take it for granted that nothing in the future will be able to surpass that effort with which our people participated in this gigantic work. In the flood-plain of the regulated Tisza, the land is indeed a large open-air museum. At the same time, however, the natural conditions here have brought about such a biota in the area of the backwaters (Mártély and Körtvélyes backwaters), navvy-ponds, in the environment of meadows and gallery forests which are unique features of the Hungarian Plain and therefore their conservation is necessary. The area still bears in a lesser or greater degree the marks which characterized it before and after the regulation of the Tisza, and this is the reason for its having received the task to conserve the old and new local characteristics, the zoological and floristic values for the succeeding generations, to serve the purposes of research and education and to satisfy the increasing social demands on nature (recreation).

Hydrological conditions

In the XIXth century, man has brought about great changes in the hydrographical features of the natural Tisza region by planned anti-inundation work. As a consequence of the regulation of the Tisza, the hydrological conditions changed, the level of the flood increased by the damming of the flood-plain, at the same time, the depth of the river also increased. During these works stagnant waters (ox-bow-lakes) formed in the flood-plain and in the flood area of the Tisza, which have for the most part retained the original hydrographical characteristics. From 1856 to 1932, 112 short-cuts were made on the Tisza. The most important data in connection with these cut-offs are the following: In such river sections where the channel deteriorated and widened, it was regulated.

There are two backwaters in the nature conservation area: the Körtvélyes backwater and the Mártély one. The Mártély backwater serves for the purpose of recreation, while the Körtvélyes one is a severely protected nature conservation area, a study area for the purpose of research, observation and education.

The location of the backwater

The Körtvélyes backwater is situated on the left bank of the Tisza in its section ranging from 201 riv. km to 203 riv. km. Its length is about 4.7 km and its water area about 60 ha. The backwater is approx 4.0 m deep and in high-water periods its depth increases. It has connection with the Tisza river itself only in periods of flooding. Its water supply, which is provided by the Körtvélyes pump of 1.24 m^3/s capacity — except in period of flooding — is solved only partly.

Pollution of the backwater

The pollution load in the Körtvélyes backwater originates from several sources, of which the following ones should be mentioned here:

— meteoric and sewage water from Orosháza, Szentetornya, Kakasszék, the Institute of Kútvölgy
— agricultural waste waters
— residues of herbicides
— run-offs from the rice-plantation of the State Farm of Hódmezővásárhely (450 ha) and drain water.

Since the backwater is a kind of impounded water, the exchange of water is little during summer, which circumstance accelerates the process of pollution. Self-purification of water decreases. The pollution with organic materials results in a luxuriant growth of aquatic plants. The enormous mass of decaying plants which sediment to the bottom of the channel promote the process of filling up. Water plants are able to accumulate in some measure great amounts of pesticide residues, thereby diminishing the concentration of these agents in the water.

Materials and Methods

In these investigations sample taking was considered essential. Good sampling is indispensable in obtaining exact experimental results and in making these results utilizable in practice. After the careful survey of the experimental area, the place of sampling was allocated by keeping in view the object of the experiment. All factors that might influence the composition of the water sample were taken into consideration. We worked with dipped samples in each case. Temperature was measured with mercury, with an accuracy of 0.1—0.2 °C.

In the measurement of coloration, the water samples were compared with known concentrations of potassium chloroplatinate and cobalt chloride. The determination of total dissolved materials was made by filtering known quantities of water samples through membrane filters of 0.45 μ pore size, and by condensing the filtrates by evaporation after which drying at 105 °C and weighing followed.

The pH of water was measured with an electric pH meter. Total hardness of water was determined with 0.5 M Komplexon III solution to be standardized. Titration was carried out at pH 10 in the presence of Erichrom-black T indicator, until it changed from red to violet. The results are given in GH° (German Hardness°). Calcium was determined by complexometry with 0.05 M standard Komplexon III solution. Titration was carried out at pH 12—13 in the presence of Murexid indicator until the lilac colour appeared. Sodium concentration was measuredd with flame photometer at 589 nm. Ammonia determination was made on the basis of the consideration that the ammonia mercury (II) iodide complexon produces a yellowishbrown compoun with Nessler reagent in alkaline medium. Colour intensity of the solution is proportional to the ammonia content. The measurements were performed at 400 nm.

In the determination of nitrite, the nitrite ions were diazotated with sulfanilic acid, and the diazonium compound was made to react with alpha-naphthylamine. The compound produced was reddish-violet in colour and its colour intensity was proportional to the concentration of nitrite ions. Extinction was measured at 520 nm.

In nitrate determination, the solution was made to react with sodium salicylate in H_2SO_4-containing medium and the compound obtained possessed a yellow colour. Intensity of colour is proportional to nitrate content. The measurement was made at 410 nm.

In phosphorus determination a blue colour develops if the orthophosphates react with ammonium molybdate in the presence of ascorbic acid. The intensity of colour is proportional to the amount of the orthophosphate ions.

Concentration of chloride ions was measured by titration with standard 0,1 N mercury nitrate solution in the pH range 7 to 10 in the form of mercury chloride. The end point was indicated with potassium chromate solution.

In sulfate determination the water samples were allowed to flow through cation exchange resin in an alcoholic medium. Titration was made with 0.02 N lead nitrate in water in the presence of dithizon indicator. The concentration of dissolved oxygen was determined by Winkler's method. For the measurement of chemical oxygen demand the potassium permanganate method was used. The samples were boiled in 0.01 N $KMnO_4$ solution in sulfuric acid-containing medium for 10 min. In this way we obtained the amount of oxygen utilized for the oxidation of the organic materials.

The water sample was boiled in 0.025 N potassium bichromate (known amount) solution acidified with sulfuric acid for 1 h. The surplus oxidizing agent was titrated with 0.025 N ferri (II) ammonium sulfate in the presence of ferroin indicator until the indicator changed from blueish-green to reddish-blue.

Results

The components investigated were plotted in the function of time. The water to be found under natural conditions is always a solution. The total salt concentration of the backwater was variable. In early spring its value was generally 200—260 mg/lit, in late summer even increasing to 400—500 mg/lit. The salt concentration of the backwater depended on the intensity of evaporation at the lake surface (Fig. 1).[2]

Not only the quantity of total dissolved inorganics is decisive but their qualitative composition, as well. Because of that the contents of dominant ions (Ca, Mg, Na, K, Cl, SO_4, HCO_3, CO_3) were also determined.

Körtvélyes-backwater 31. 3. 1978. (spring)

	mg liter^{-1}	Reactive weight	mg — equivalent	Equivalent %S	a cm
K	5.5	39.102	0.140	3.577	0.24
Na	16.0	22.990	0.696	17.782	1.19
Ca	48.0	20.040	2.395	61.191	4.11
Mg	8.3	12.156	0.683	17.450	1.17
			3.914	100.000	
CO_3	0.0	30.004	0	0	
HCO_3	142	61.017	2.327	50.686	3.40
Cl	22	35.453	0.620	13.505	0.91
SO_4	79	48.031	1.644	35.809	2.40
			4.591	100.000	
			I=8.505		

Radius of the circle: $0.572\sqrt{8.505}=0.572\times2.92=1.67$ cm

$\sqrt{I}=\sqrt{8.505}=2.92$

$0.023\sqrt{I}=0.023\times2.92=0.06716$

Total dissolved in organics = 220 mg/l

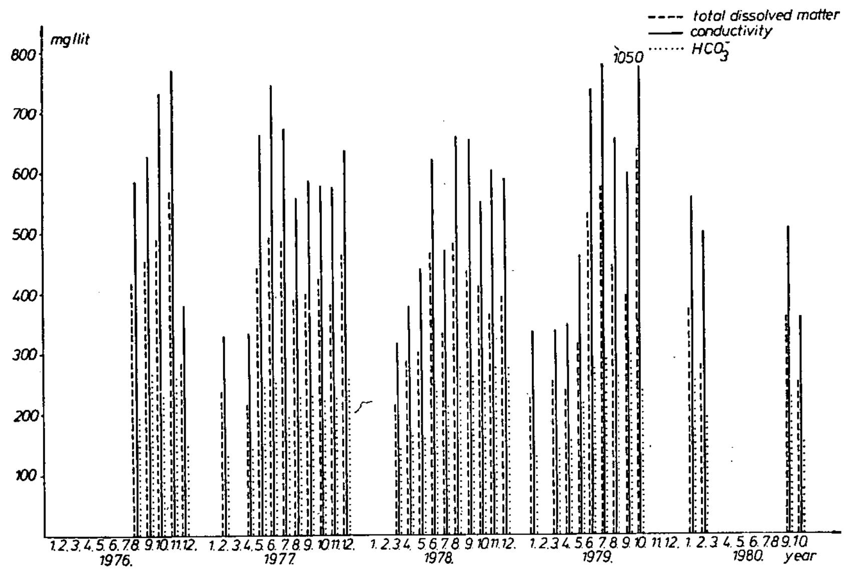


Fig. 1. Changes of total dissolved matter, conducticity and HCO_3^- content in Körtvélyes backwater.

In the backwater, calcium was the dominant ion (Fig. 2), with values ranging from 39.0 mg/lit. to 76.0 mg/lit. Magnesium exhibited similar fluctuations, though with lower values (8.0 mg/lit). The standard value of Mg was 15.0 mg/lit.

Körtvélyes-backwater 19. 6. 1978. (summer)

	mg liter^{-1}	Reactive weight	mg — equivalent	Equivalent %S	a cm
K	7.0	39.102	0.179	2.409	0.21
Na	71.3	22.990	3.101	41.730	3.66
Ca	56.2	20.040	2.802	37.707	3.30
Mg	16.4	12.156	1.349	18.154	1.59
			7.431	100.000	
CO_3	0	30.004	0	0	0
HCO_3	235	61.017	3.851	54.057	4.737
Cl	49.6	35.453	1.399	19.638	1.721
SO_4	90.0	48.031	1.874	26.305	2.305
			7.124	100.000	
			I = 14.555		

Radius of the circle: $0.57\sqrt{14.555} = 0.572 \times 3.81 = 2.18$ cm

$\sqrt{I} = \sqrt{14.555} = 3.81$

$0.023\sqrt{I} = 0.023 \times 3.81 = 0.08763$

Total dissolved in organics = 410 mg/l

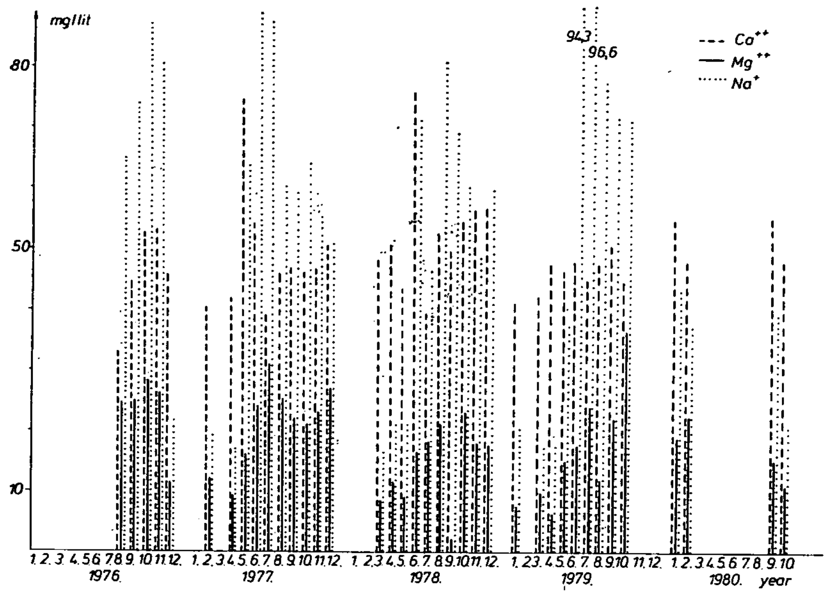


Fig. 2. Changes in Ca^{++}, Mg^{++}, and Na^{+} contents in Körtvélyes backwater.

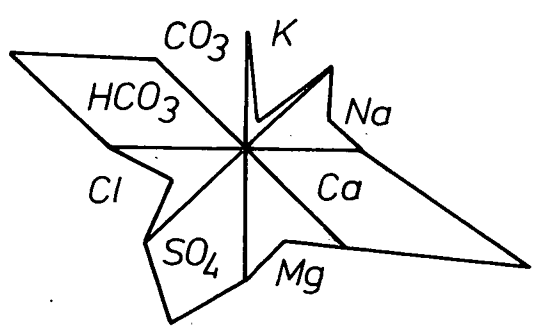


Fig. 2/a

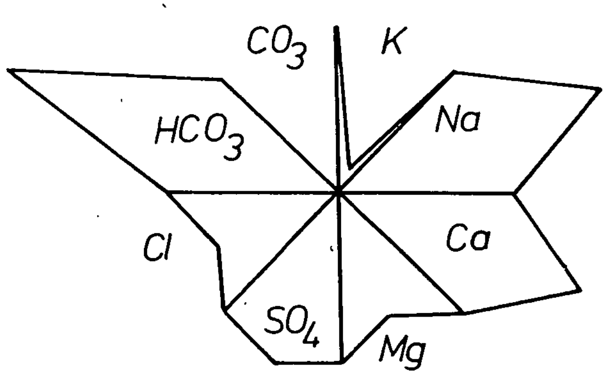


Fig. 2/b

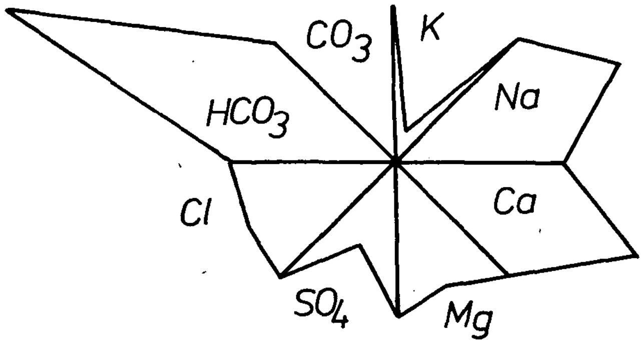


Fig. 2/c

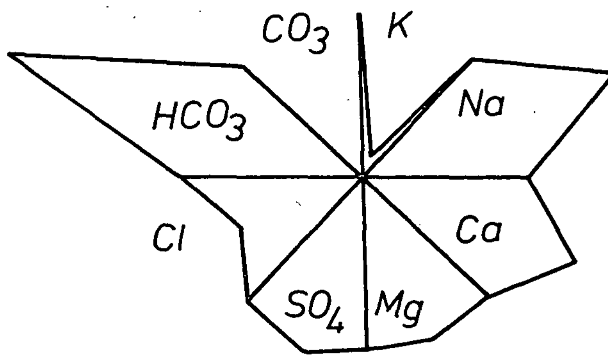


Fig. 2/d

The chemical composition of the backwater is illustrated in Maucha's diagram. Four characteristic water qualities were picked out (from spring, summer, autumn and winter). Eight dominant ions: Ca, Mg, Na, K, Cl, SO_4, HCO_3, CO_3 were used in the construction of Maucha's star diagram. The size of this diagram is proportional to the total ion concentration of water and indicates also the relation of ions to one another.

In regard of cations the type of the backwater was a calcium one, in the dry season a calcium-natrium one, and in periods of dilution with precipitation or after flooding with Tisza water calcium-magnesium one. In regard of anions, its type was a hydrocarbonate one. It also occurred sometimes that beside hydrocarbonate sulfate also appeared. Fig. 3 shows the seasonal changes of chloride and sulfate ions.

Values for total hardness (Fig. 4) varied between 8.1 GH° and (Fig. 4) 12.9 GH°. Apart from autumn maxima, fluctuations of the value of approx 9 GH° ($\pm$1.5 GH°) can be accepted. Its standard value was about 11 GH° independently from the place and year of sampling. The amount of sodium ions (Na%) in the percentage of total cations was 32%. Fluctuations above this value were smaller (max. 40%) than below it (min 17%).

The use of fertilizers in increasing amounts is an inevitable consequence of developing agriculture. Hungarian and international data equally suggest that the amount of fertilizers in agriculture has increased. This also applies to the catchment

Körtvélyes-backwater 25. 9. 1978. (autumn)

	mg liter^{-1}	Reactive weight	mg — equivalent	Equivalent %S	a cm
K	5.5	39.102	0.141	1.910	0.17
Na	69.0	22.990	3.001	40,664	3.63
Ca	49.0	20.040	2.445	33.130	2.96
Mg	21.8	12.156	1.793	24.296	2.17
			7.380	100.000	
CO_3	0	30.004	0	0	0
HCO_3	262	61.017	4.294	55.948	4.99
Cl	49	35.453	1.382	18.006	1.61
SO_4	96	48.031	1.999	26.046	2.32
			7.675	100.000	
			I=15.055		

Radius of the circle: $0{,}572\ \sqrt{15{,}0555} - 0{,}572 \times 3{,}88 = 2{,}22$ cm

$\sqrt{I} = \sqrt{15.055} = 3.88$

$0.023\ \sqrt{I} = 0.023 \times 3.88 = 0.08924$

Total dissolved in organics=436 mg/l

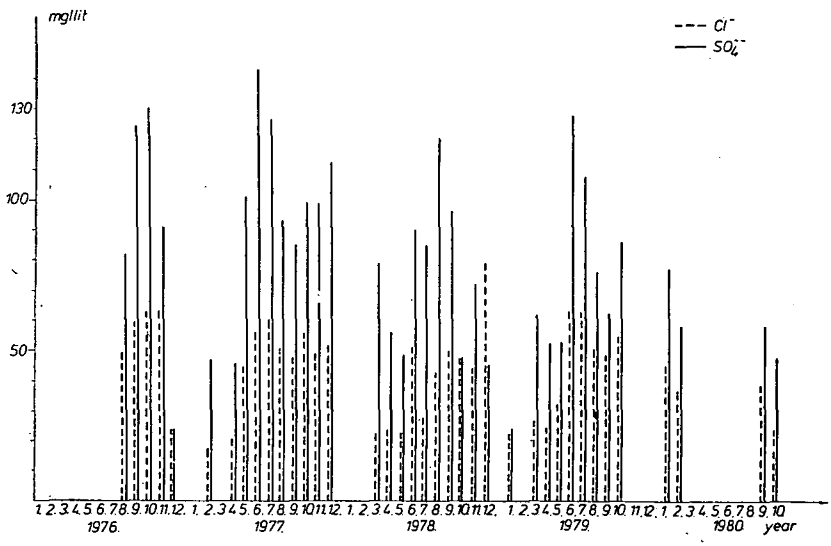


Fig. 3. Changes of Cl^- and SO_4^{--} in Körtvélyes backwater.

basin of Körtvélyes backwater. The effective agents of fertilizers consist mainly of phosphorus and nitrate. Their changes are illustrated in Fig. 5. Nitrate concentration of the backwater exhibited a slightly increasing tendency, inspite of that, however, it may be said to have had first quality water on the basis of its NO_3 content.

Körtvélyes-backwater 19. 12. 1978. (winter)

	mg liter^{-1}	Reactive weight	mg — equivalent	Equivalent %S	a cm
K	4.70	39.102	0.120	1.722	0.15
Na	59.80	22.990	2.601	37.328	3.23
Ca	56.10	20.040	2.799	40.169	3.47
Mg	17.60	12.156	1.448	20.781	1.80
			6.968	100.000	
CO_3	0	30.004	0	0	0
HCO_3	278	61.017	4.556	63.658	5.50
Cl	59	35.453	1.664	23.250	2.01
SO_4	45	48.031	0.937	13.092	1.13
			7.157	100.000	
			I=14.125		

Radius of the circle: $0.572\ \sqrt{14.125}=0.572\times3.76=2.15$ cm

$\sqrt{I}=\sqrt{14.125}=3.76$

$0.023\ \sqrt{I}=0.023\times3.76=0.08648$

Total dissolved in organics = 399 mg/l

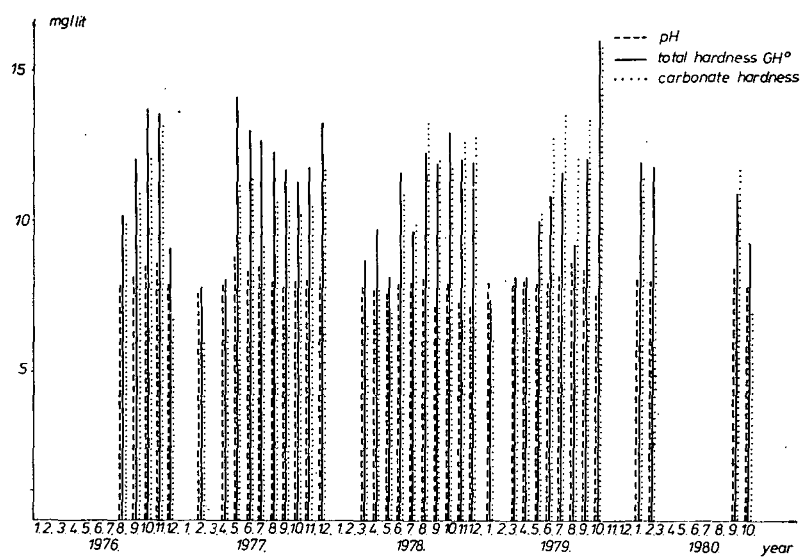


Fig. 4. Körtvélyes backwater.

Ammonium ion concentration was generally below 0.5 mg/lit. Values rangin from 0.10 mg/lit to 0.15 mg/lit or close to them were often found. The maximum was 0.73 mg/lit, not in excess of 1 mg/lit. During winter the values were naturally always higher than in other periods.

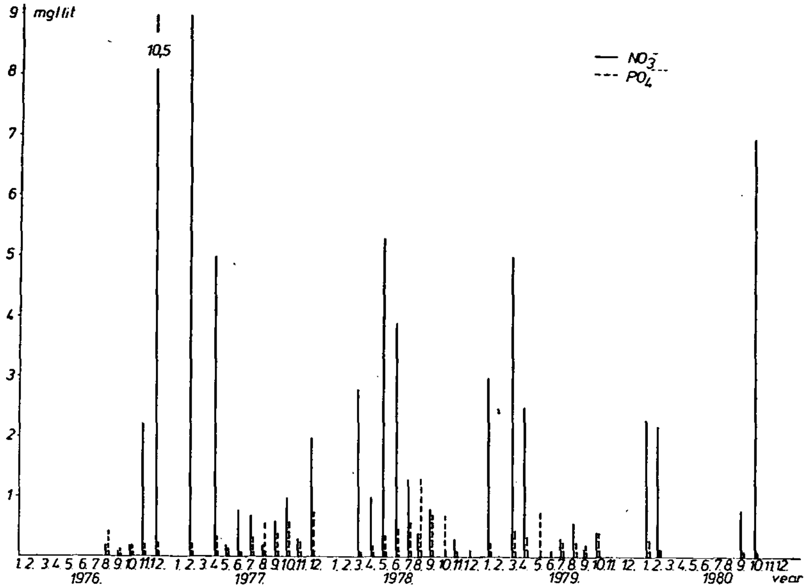


Fig. 5. Changes of NO_3^- and PO_4^{---} contents in Körtvélyes backwater.

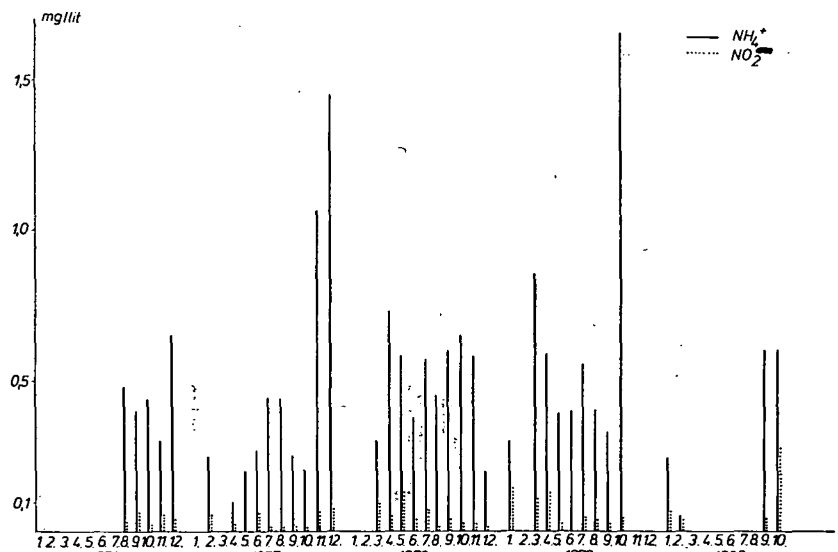


Fig. 6. Changes of NH_4^+ and NO_2^- contents in Körtvélyes backwater.

The concentration of nitrite ions was low. It may be characterized at the most by the value in the third place of decimals (Fig. 6).

In the analysis of surface waters the organic matter content is one of the most important qualitative characteristics. The changes in the organic matter contenst

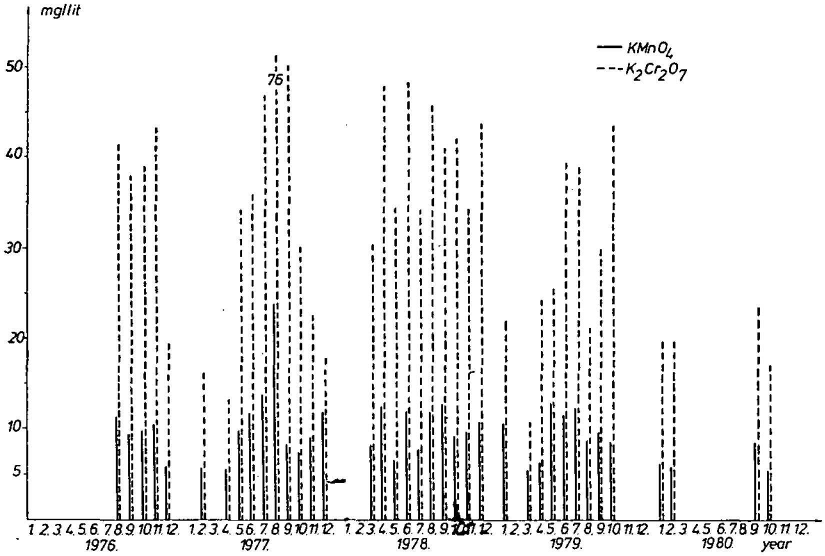


Fig. 7. Changes of organic matter content in Körtvélyes backwater.

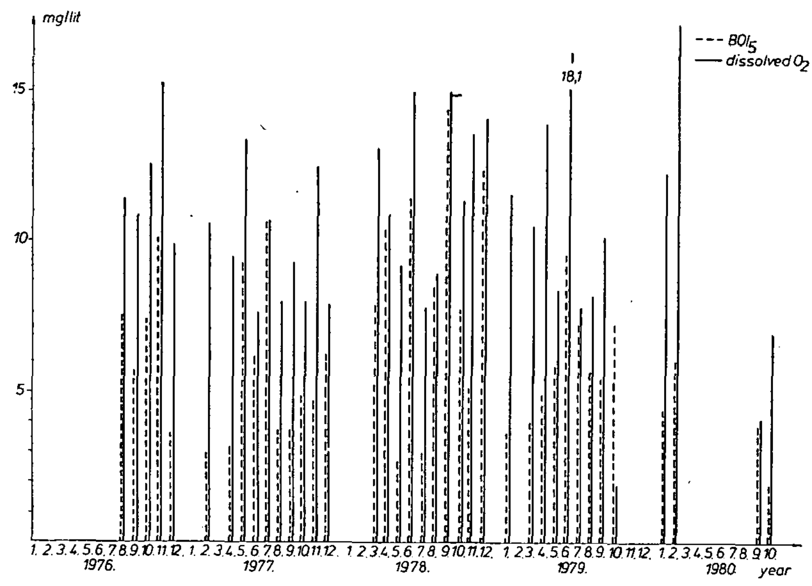


Fig. 8. Changes of dissolved O_2 and BOR_5 in Körtvélyes backwater.

of surface waters are partly the results of natural processes, partly those of human activity — depending on the circumstances. Because of that, the knowledge of this parameter may furnish us with valuable information concerning organic load and self-purification capacity. Fig. 7 shows the periodic changes of organic matter content. Character of oxidizable organic matter exhibited only small changes. The relative amount of easily oxidizable organic matter generally also diminished slightly, the ratio $COD_{K_2Cr_2O_7}/COD_{KMnO_4}$ slightly increased.

Oxygen and carbon dioxide are the two basic materials in the metabolic process between organism and its environment. Nearly every organism needs oxygen for the liberation of the energy content of organic nutrients.

The oxygen content of water depends not only from the physical factors (temperature being the most important among them) but also from the amount of organic materials present in it as well as the rate of oxygen production and consumption of the organisms.

Dissolved oxygen content proved to be always in excess of 7.0 mg/lit, and the least oxygen saturation 89%, which according to COMECON standards corresponds to first grade water quality. In Fig. 8 the changes of dissolved oxygen content and 5-day biochemical oxygen demand are illustrated.

Literature

PAPP, F. (1973): Harmony between regional water management and human environment (in Hungarian), Vízgazdálkodás No. 1. 17—26.

PAPP, F. (1974): Environmental protection and nature conservation connected to water management (in Hungarian), Vízgazdálkodás és Környezetvédelem No. 1. 10—15.

SEBESTYÉN, O. (1963): Introduction to limnology (in Hungarian) Publishing House of the Hungarian Academy of Sciences, Budapest.

Proceedings of the Kiskunság National Park

Informations about the Kiskunság National Park

Protected natural resources in Hungary

Nature conservancy

Our natural environment (in Hungarian)

National Water Authority (1964): Some criteria, and standards of uniform water qualification and the principles of classification (in Hungarian), OVH, Budapest.

National Water Authority (1966): Water quality analyses and their interpretation (in Hungarian) OVH, Vízg. Főosztály, Budapest.

MAUCHA, R. (1932): Hydrochemische Methoden in der Limnologie. In: THIENEMANN, a. (edit.): Die Binnengewässer, Bd. *13,* 1—73. Stuttgart.

A körtvélyesi holt ág vízminősége

K. FÜGEDI KLÁRA és H. MÉSZÁROS MÁRIA

ATIVIZIG; József Attila Tudományegyetem, Szeged, Magyarország

Kivonat

1976—1980-ig vizsgáltuk a körtvélyesi holt ág vízminőségét. Részletesen foglalkoztunk a holt ág oxigénháztartásával, sóháztartásával, illetve a mezőgazdaságból származó szennyezéssel. Megállapíthattuk vízkémiai szempontból a holtág szezonális változásait és a tápanyag feldúsulását. Megfigyelhettük a Tisza áradásakor bekövetkező öblítő hatását is. Az 5 éves időszakban kapott eredményeink arra a következtetésre juttattak, hogy a körtvélyesi holt ág vízminőségében lényeges változás nem következett be.

Kvalitet vode mrtvaje Körtvélyes

K. Fügedi Klára i H. Mészáros Mária

Vodoprivredna uprava Tise; JATE, Szeged, Hungaria

Abstrakt

Ispitivanje kvalitata vode mrtvaje Körtvélyes vršeno je u periodu 1976—1980. godine. Detaljnije je proučavan režim O_2 i saliniteta kao i zagadjivanje preko poljoprivrede. Utvrdjena je sezonska promena hemizma mrtvaje kao i povećavanje organskih materija. Takodje je zapažena i ispirajuća uloga Tise pri visokim vodostajima. Rezultati petogodišnjih istraživanja ukazuju na činjenicu da u kvalitetu vode mrtvaje Körtvélyes nisu nastale značajne promene.

КАЧЕСТВО ВОДЫ СТАРИЦЫ КЕРТВЕЛЬЕШ

К. Фюгеди (Кеменешне)
Водное управление Нижнетисянского края, Сегед

М. М. Хорват
Университет им. Йожефа Аттилы, Сегед

Резюме

1976—1980 гг. узучили качество воды старицы Кертвельеш. Занялись изучением ее кислородного и солевого состава, а также засоренности ее сельськохозяйственными отходами. С помощью гидрохимии удалось определить сезонные измения, а также накопление питательных веществ в водоемах и старицах. Ознакомились также с наступающим промывательным влиянием воды после наводнения Тисы. Полученные пятилетние результаты показали; что в старице Кертвельеш значительных изменений в составе воды не наблюдалось.

Tiscia (Szeged) Vol. XVII, pp. 29—49 (1982)

HYGIENIC BACTERIOLOGICAL INVESTIGATIONS OF THE BACKWATERS AT MÁRTÉLY AND KÖRTVÉLYES

MÁRIA HEGEDÜS and MARGIT ZSIGÓ
Public Health Station of Csongrád County
H-6701 Szeged, Hungary
(Received 20 September, 1981)

Abstract

In the area of the Mártély Region of Scenery Protection two backwaters can be found (at Mártély and at Körtvélyes) the water of which has been regularly investigated within the last five years. On the basis of the results of these investigations conclusions could be drawn concerning the quantitative and qualitative conditions of the obligate and facultative faecal indicator bacteria, and also the changes in space and time of the incidentally occurring bacterial contamination could be followed. 202 samples were withdrawn from the water of both backwaters and 910 investigations were carried out.

The obtained results are as follows:

— In the majority of cases the water of both backwaters proved to be of Ist class "pure" water quality.
— The obligate faecal indicator bacteria could be detected only rarely and in a small number.
— The quantitative change of the facultative faecal indicator bacteria announced well the floods, the rinsing of the sewage lagoons (in the Mártély backwater) and the stagnant bodies of water developed at high water and low water.
— The water quality of both backwaters showed a seasonal dynamism which could be observed also on the basis of the results of the hygienic bacteriological investigations.

Introduction

The creation of regions of scenery protection is besides the aim of nature preservation, significant also from the aspects of a general cultural and environmental arrangement because it makes possible a general scenery protection organized uniformly and extending to all the components of the scenery. The Mártély Region of Scenery Protection has been assigned after the Tihany and Badacsony regions as the third Region of Scenery Protection in Hungary by the decree 390/1971 of the OTVH (National Office for Nature Preservation). In the area of this region of scenery protection two backwaters can be found: those at Mártély and Körtvélyes. Though the physiognomy of both backwaters is different quite a number of similarities is observable.

Description of the backwaterta Mártély:

The Tisza backwater at Mártély is a flood-plain backwater on the left bank of the river Tisza, separated from the river by a low summer-time dam, and located between kilometer marks of 206.4 and 208.5 of river Tisza. It is connected with the river only at high water. Besides the flood pariod the water supply of the backwater is solved only partially because the inland waters are lifted up from the main channel of Mártély—Darvasszék from an area of about 48 km^2 by a pump station of only 1.0 $m^3 s^{-1}$ (VÍZITERV 1972—74). The water level of the backwater follows with a smaller shift the level of the main Tisza river which is 2—3 m at low water and 5—6 m at high water. In normal weather the river Tisza inundates the area at springtime and early summer by a water layer of 1—3 m whereas in rainy years floods are occurring also at late fall and in winter as well (EGYED 1979). The northern branch of the backwater became swampy and its southern end is connected with river Tisza by a trench of 3—4 m width. At higher water (floods) of river Tisza, the water of the river flows through the backwater and, respectively, it inundates the entire flood-plain, including also the recreation area established in the riverside belt. When the water level decreases, excess water returns to the river from the backwater through the southern connecting channel. Though the floods are causing significant damages in the recreation area, this is the only way for the exchange of water since the flow of water through the backwater is not ensured (ZSÍROS 1977).

The utilization of backwaters is known to be manysided. The Mártély backwater is similarly a surface water serving partly as a reservoir of inland waters and partly for recreation and bathing purposes. Though the pisciculture is not intensive, also netting is carried out each falltime by the Fishing Cooperative. At the same time the angling of the guests is ensured almost during the whole year. Water-chestnut is growing in most part of the water surface since only the bathing and rowing areas have been liberated from this plant.

A detailed description and characterisation of the Körtvélyes backwater can be found in the paper of DR. KLÁRA K. FÜGEDI.

The water of both backwaters has been regularly investigated in the last five years in collaboration with the ATIVIZIG laboratory. Hygienic bacteriological investigations have been carried out in the KÖJÁL (Station for Public Health and Epidemiology) of Csongrád County since these results are quite indispensable in the evaluation of the water quality and in the comparative analysis of surface waters.

At the evaluation of the hygienic water quality the definitive parameters are in surface waters according to our opinion (DEÁK 1977) the *obligate faecal indicator bacteria:* the faecal coliform, the Streptococcus faecalis and the faecal streptococci, respectively, the so-called "enteral phages" dissolving the intestinal bacteria, the pathogen intestinal bacteria. The *facultative faecal indicator bacteria* are in turn those which may originate, besides haematotherma, to a smaller extent also from other contaminating sources.

The first complex investigation extending equally to bacteriological, chemical and biological parameters was carried out in the water of the Mártély backwater by UHERKOVICH (1971) and his associates in 1967. On the basis of the data of the bacteriological investigations it was found that the value of the coliform number exceeded the limit value from a hygienical aspect only in August, and this problem of water quality has been attributed to the stagnancy of the water in summer.

The determination of the "non-hygienic" bacterium number came into the foreground in hydrobiology in the last decade (FELFÖLDY 1981). OLÁH (1973, 1974) investigated the bacterioplankton of Lake Balaton and Lake Velence, and later called attention to the unusually high stand of bacterioplankton accompanying the fish death occurring in 1975 (OLÁH 1975).

Data are known also of the bacterioplankton of river Tisza, particularly concerning the Kisköre region (HAMAR a, b, c, TÓTH 1978). It was found that the amount of total bacterioplankton is closely related to the suspended alluvial deposit. B. TÓTH called attention also (1977) to the peculiarities of the masses of water in the floodplain. On investigating the hydroecological conditions of backwaters within the area of the Kisköre reservoir she carried out also determinations of bacterioplankton and she found that the bacterioplankton of the backwaters discloses conditions characteristic of the eutrophic waters. In summer, quite corresponding to the more intensive bacterial decomposition process, higher values have been recorded than those observed at falltime.

The hygienic bacteriological investigation of greater rivers and stagnant waters has been regularly carried out in the last decades by several investigators. The Tisza reach at Szeged was investigated by ROSZTOCZY (1935), VETRÓ, KISS and MINDSZENTY (1966) and HEGEDÜS (1979, 1980). To our knowledge, no hygienic bacteriological investigations were carried out in the Körtvélyes backwater before 1976.

Materials and Methods

In the last five years 202 samples were withdrawn from the water of the Tisza backwaters at Mártély and Körtvélyes, and 910 investigations were carried out in these samples. Sampling sites were in the Mártély backwater: at the pier of the bath, at the occurrence of sturgeons, at the occurrence of sturgeons, at the southern outfall (both last sampling sites were used only in 1975). Samples from the Körtvélyes backwater were withdrawn at the observation site of the Tisza-investigating station (weir-keeper house).

For the hygienic bacteriological investigations water samples of 100 ml and for the enrichment of Salmonella samples of 1000 ml were withdrawn at a depth of about 20 cm below the water surface. The water samples were transported under cooling to the laboratory where they were processed on the day of sampling but not later than 24 hours after sampling. The number of coliform, faecal coliform, faecal streptococcus and streptococcus faecalis, respectively, further of the Clostridium and the heterotrophic psychrophilic, mesophilic total colony-forming bacteria were determined.

The bacteriological investigations were carried out according to the "Methodological Instructions" (1977) issued by the Department for Water Hygiene of the National Institute of Public Hygiene and to the standard "Bacteriological investigation of drinking water" (1971) (in Hungarian). The detailed description of the methods of investigation and the limit values of the hygienic evaluation of water can be found in the paper of Hegedüs (1980) published in Volume XV of Tiscia.

Results of the hygienic bacteriological investigation of the Mártély backwater in the period 1975—1980

1. Results of the hygienic bacteriological investigations in 1975

According to the results of the bacteriological investigations the water quality of the backwater is as follows, on taking into account the aspects of the hygienic evaluation of surface waters (see Fig. 1).

86.8% of the investigated samples is of category I "pure" and only 13.2% is of category II "slightly contaminated". In 1975 all of the investigated parameters showed the most unfavourable values in April, June and November. At the sampling in June the water level was high due to the flood of river Tisza also in the backwater, and the resort area was covered by about 50 cm deep water. These conditions are responsible for the rather unfavourable result. In November 1975, after the recreation and bathing season, again higher values were observed at a durable low water

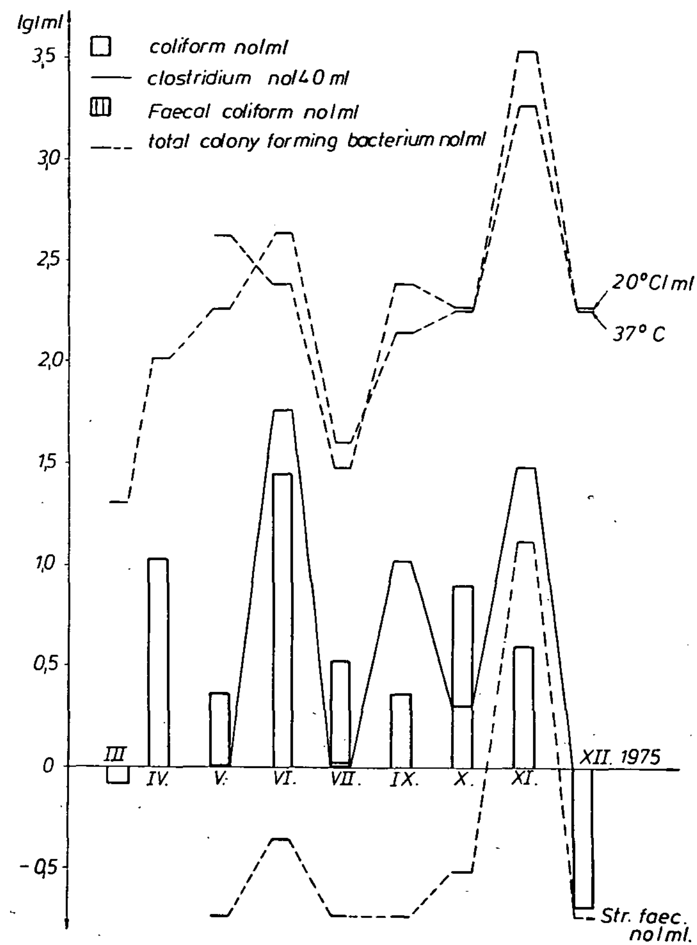


Fig. 1

level which values were indicated by the total number of colony-forming bacteria, the number of *Streptococcus faecalis* (ml and of *Clostridium*) 40 ml.

Water samples withdrawn "at the outfall" and at "the occurrence of sturgeons" (i.e. from the southern and northern reaches of the backwater) were in each case of Ist class "pure" quality according to the hygienic bacteriological investigations.

2. Results of investigations carried out in 1976 (Fig. 2)

The average, median and quarterly values of the coliform and direct bacterium numbers and the quarterly range (DEÁK 1969) were much lower than those in 1975. At the same time the numbers of the total colony-forming bacteria at 20 °C and 37 °C and the values of the *Clostridium* number/40 ml showed still not observed peak values in March and December. In these months the water of river Tisza streamed-in to the backwater from south to the north. The high values of 7000—3600/ml of

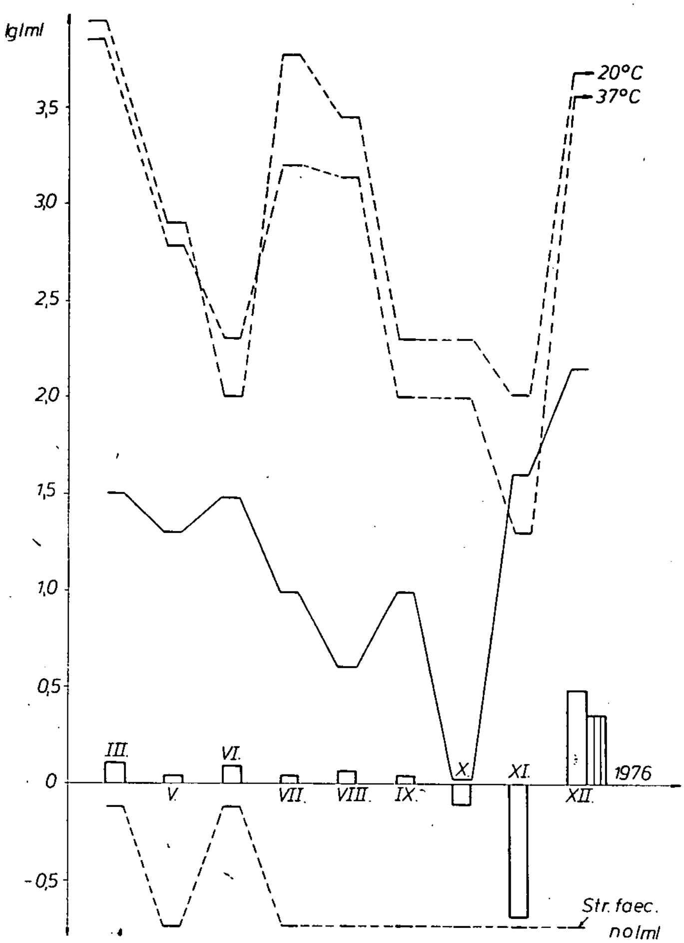


Fig. 2.

the germ count and the *Clostridium* number of 140/40 ml indicated that owing to the strong current the "silt" was mixed up in the backwater and bacteria originating from the silt formed there the "flora". During the whole year according to the values of the coliform, the *Streptococcus faecalis* numbers/ml the water quality of the backwater was Ist class "pure". On following the seasonal variations it can be stated that except for the time of floods at spring and in December, faecal contamination was hardly detectable in the water of the backwater. At the sampling site: pier of the bath of the backwater, in two years (1975—76) from water samples of 1000 ml, bacteria belonging to the Salmonella genus could be isolated only in December 1976 which proved on serotypization to be *Salmonella agona.* This serotype has been isolated already in November at the sampling site Mindszent of river Tisza. The Salmonella bacterium entered the backwater presumably with the streaming-in of Tisza water.

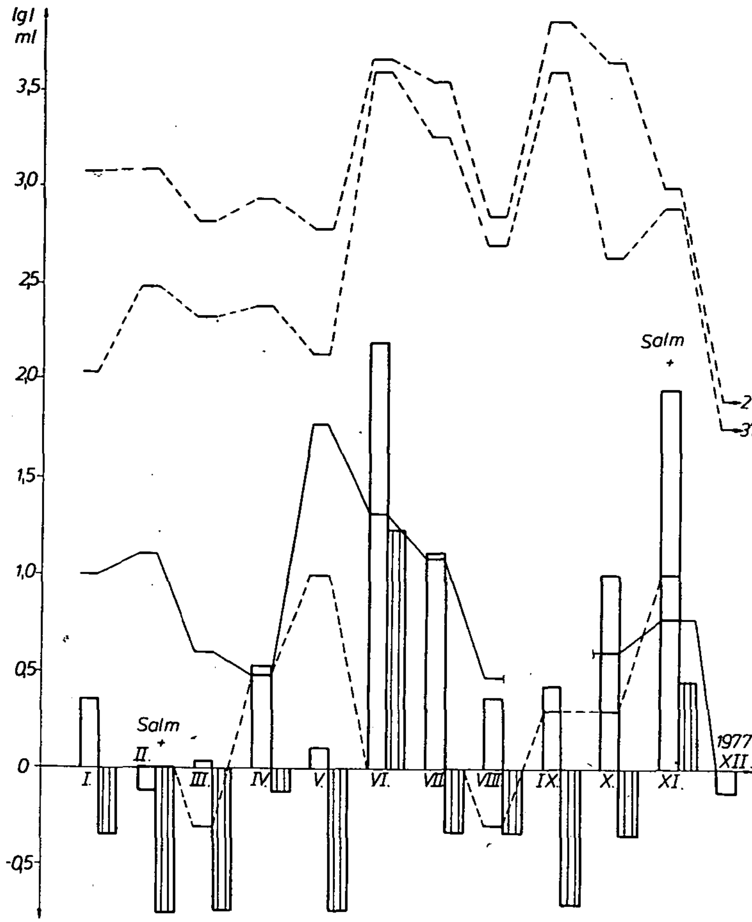


Fig. 3

3. Results of the hygienic bacteriological investigations in 1977 (Fig. 3)

On the basis of the hygienic water evaluation 75% of the samples was Ist class "pure" whereas 25% was IInd class and qualified as "slightly contaminated". The percentage of Salmonella positivity slightly increased in comparison to that observed in former years, it disclosed a value of 16.6% on the basis of a serial investigation. However, this value is still favourable since it does not exceed the limit value of 33%. The water sample withdrawn from the Mártély backwater was *Salmonella*-positive in February and in November. In both cases strains of *Salmonella* typhi-murium were bred which differed from each other from the aspect of phage and biotype. The phage type of the strains bred in February was not typifiable whereas its biotype was: 3. At the same time strains of Salmonella typhi-murium isolated from river Tisza showed also these phage and biotypes. Strains, however, of *Salmonella typhi-murium* isolated from the backwater in November proved to be of phage type la. var. ld. and of biotype 2.

On observing the seasonal variations it can be stated similarly that the least favourable results occurred at the floods at early springtime and early summer floods, furthermore in case of "stagnant water" at late falltime, with the difference that the value of faecal indicator bacteria was much higher than in 1976. After the flood in May e.g. the peak value of the coliform number was 160/ml and the value of the faecal coliform number 17/ml. After the "stagnant water" in summer the values of the aforementioned parameters changed to 92/ml and 2.3/ml, respectively. On the basis of the results of investigations it could be stated as well that immediately after the flood of the backwater, numbers of the coliform, the heterotrophic mesophil and psychrophil bacteria increased rapidly.

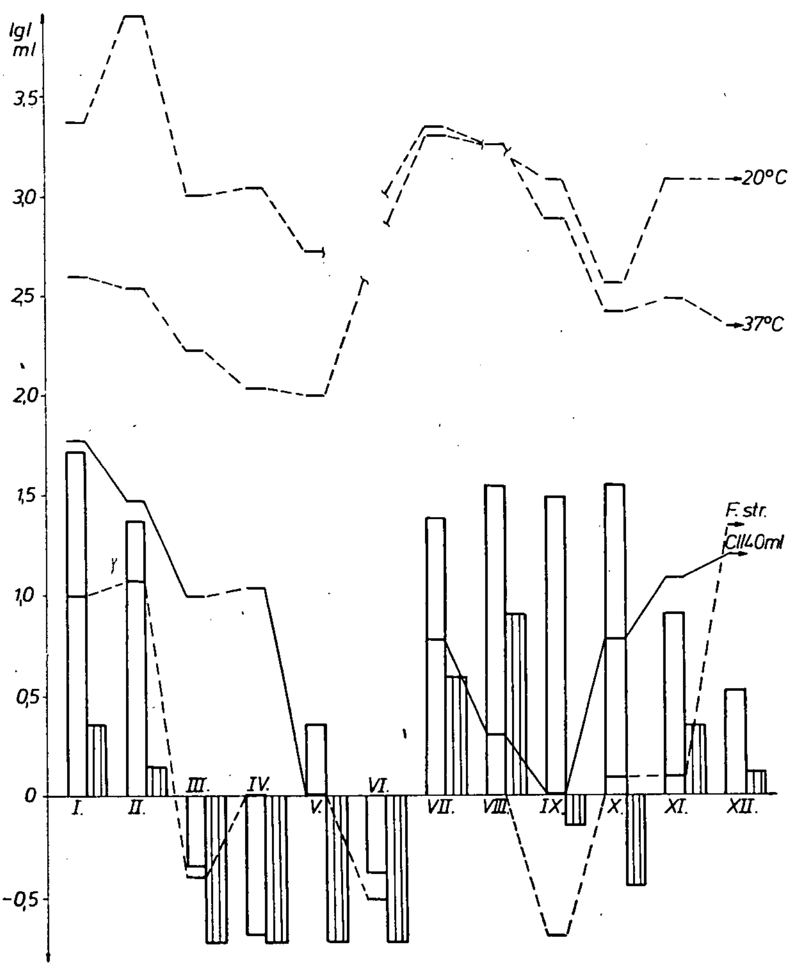


Fig. 4

4. Results of bacteriological investigations carried out in 1978 (Fig. 4)

The hygienic water quality of the backwater was on the basis of the investigated parameters in 42% of class II "slightly contaminated" and in 58% of Ist class, "pure". Bacteria belonging to the genus *Salmonella* could never be detected in any 1000 ml water sample. In 1978 the river Tisza had from springtime to midsummer a high water level and flooded the backwater also even at late falltime several times. Thus, owing to the intensive rinsing, the obligate faecal indicator bacteria were present up to June 15 only in a relatively small number. However, after July 15 these values increased significantly, due likely to the fact that the stagnancy of the water occurred during the durable floods, at a higher water level. This state developed not only in the river bed but also in the water mass covering the entire flood-plain. This is shown also by the peak values (not measured up to the present) of the medians and of the mean values.

5. Results of the bacteriological investigations carried out in 1979—1980 (Fig. 5)

In these years water samples were withdrawn mainly in the summer bathing season. The results disclosed rather great deviations in the order of magnitude in comparison to those observed in the previous years but their characters were similar to each other. On the basis of the hygienic parameters of investigation the water quality was in both years mostly Ist class "pure" and only in some cases IInd class "slightly contaminated". The duality characterizing the backwater could be recorded also in these years: flooding, durable flood, and the bacteriological results of the stagnant water at high and low water. Bacteria belonging to the genus *Salmonella* could never been detected in 1000 ml water samples during the mentioned two-year period.

6. Results of investigations of bacterioplankton (Fig. 6)

Total bacterium counts have been determined in the period 1975—1978. In the water of the Mártély backwater in general values ranging from 1 to 10 millions/ were the most frequently observed during four years. Values of the direct bacterium count/ml did not show any unequivocal correlation with the number of the cultured all colony-forming bacteria. However, it could be stated that the total bacterium count is in general higher (12—58 millions/ml) when the backwater is being flooded by the river Tisza. These observations can be interpreted by the stirring of the sediments of the backwater, and on the other hand, they point to the also otherwise high bacterioplankton stand of river Tisza. The amount of bacterioplankton recorded in the Mártély backwater was on average greater than that observed in Lake Balaton but slightly lower than that recorded in the backwaters in the area of the Kisköre reservoir. In accordance with the results of investigations of B. Tóth (1977) the amount of bacterioplankton was in the autumnal season in general smaller when the Tisza was not flooded.

On summarizing shortly the results of bacteriological investigations carried out in the period 1975—1980 in the water of the Mártély backwater it can be stated that

1. The water quality of the Mártély backwater is characteristically of Ist class type "pure" according to the examined hygienic parameters.

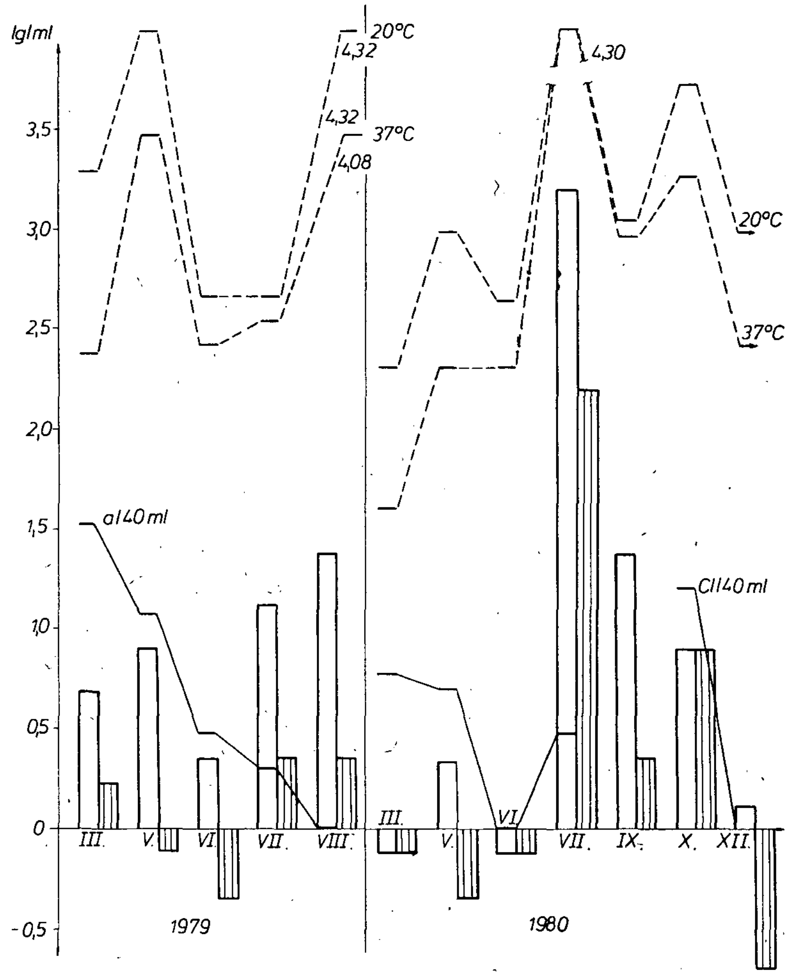


Fig. 5

2. Bacteria belonging to the genus *Salmonella* could be detected only occasionally and thus the percentage of the occurrence of *Salmonella* is low and it does not exceed the limit value of 33%.

3. The median values showed during the last six years a remarkable constancy at the coliform, faecal coliform, *Streptococcus faecalis* and faecalis streptottuc counts/ml values.

4. The results of the hygienic bacteriological investigations indicated the least favourable water quality in 1978 which can be attributed to the repeated floods and to the subsequent stagnancy at high water.

5. The counts of all the colony-forming bacteria at 20 °C and 37 °C further the median values of the *Clostridium* count/40 ml were very varying in this period. The number of psychrophilic bacteria (20 °C) indicates contamination of non-faecal origin but it may point also to an infiltration or stirring up from the soil and from

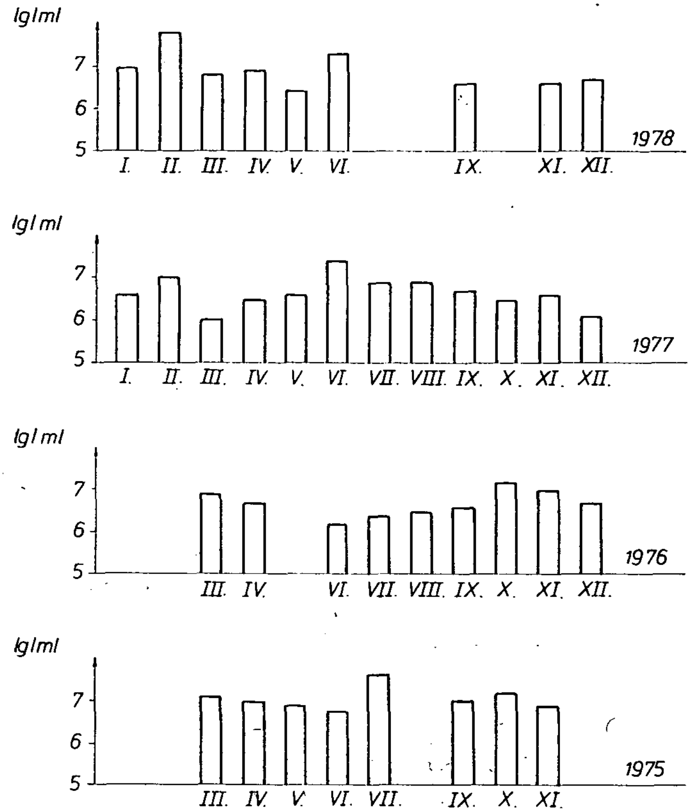


Fig. 6

the sediment. This was observable when the backwater was flooded by river Tisza or when its water was inpouring into the southern connecting channel, stirring up the sediment of the water mass. The presence of a great number of other facultative faecal indicator bacteria in the water of the backwater pointed to the predominance of the mineralization of organic substances and of the anaerobic processes.

6. At the peak values of the coliform and faecal coliform counts generally also the amount of all the colony-forming bacteria significantly increased and on the other hand the value of the psychrophilic bacteria/ml was always higher than that of mesophilic bacteria.

Results of the hygienic bacteriological investigations of the Körtvélyes backwater in the period 1976—1980

1. Results of bacteriological investigations carried out in 1976 (Fig. 7)

On taking into account the limit values of the hygienic water evaluation 75% of the investigated samples was Ist class "pure" whereas 25% was IInd class "slightly contaminated". The peak value of the coliform count/ml appeared in August and

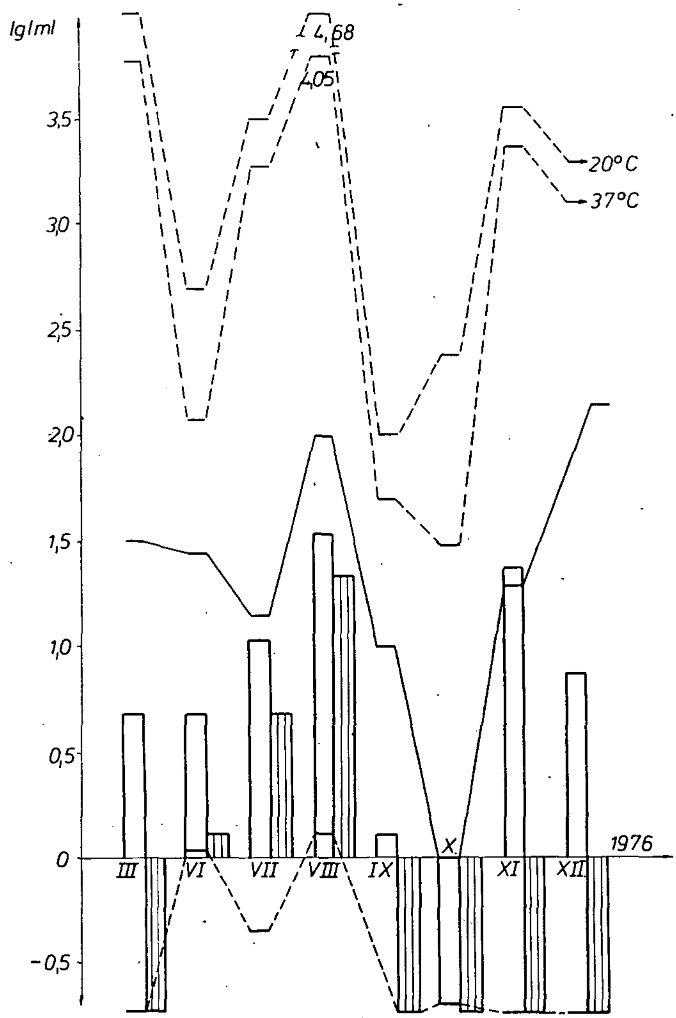


Fig. 7

October. The peak value of the coliform count in August was followed in the order of magnitude by the values of the counts of the faecal coliform, the psychrophilic and mesophilic bacteria, the *Streptococcus faecalis* and of *Clostridium*. These values characterized the typical stagnant water conditions of the backwater. The higher values recorded in November pointed to the flood of river Tisza.

Of 1000 ml volumes of the investigated samples bacteria belonging to the genus *Salmonella* were isolated only in one single case, on June 30, 1976. These proved to be of the following serotypes: *Salmonella schleissheim, Salmonella arizonae* (38; r; z.) and *Salmonella reading* (O_5 antigen positive). This latter serotype was at that time typical in various sewages of Csongrád county. A rarely isolated serotype is *Salmonella arizonae* which is frequent according to data of literature mainly in animal colonies.

2. Results of bacteriological investigations carried out in 1977 (Fig. 8)

66.7% of the investigated samples was Ist class "pure" whereas 33.3% was IInd class "slightly contaminated" on the basis of the limit values of the hygienic water evaluation. The percentage of *Salmonella* positivity was similar to that observed in the previous year i.e. bacteria belonging to the genus *Salmonella* could be detected in water samples of 1000 g only in August, and these proved to be O_5 antigen-deficient *Salmonella typhi-murium*.

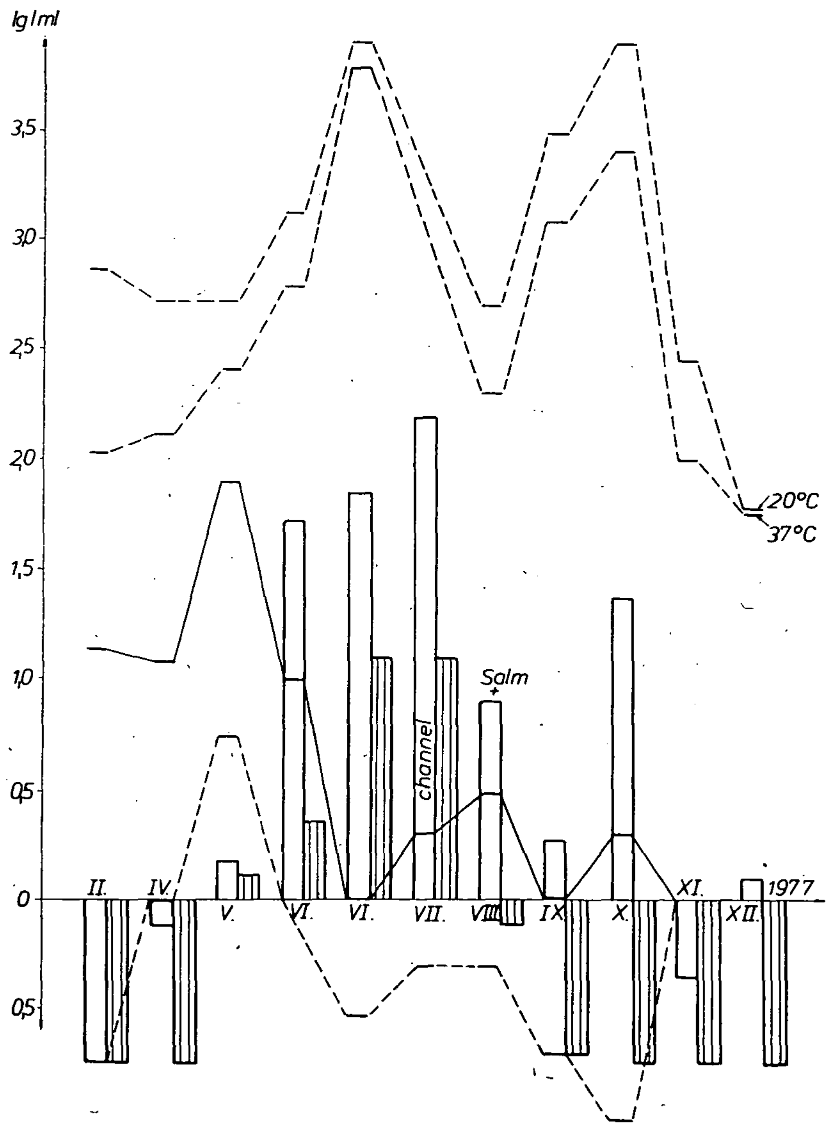


Fig. 8

On 13 August 1977 fish deaths were observed in the water of the backwater but this was reported only on 17 August. Thus water samples could be withdrawn after 5 days i.e. on 18 August only. It is likely that the eventual contamination would be indicated besides the *Salmonella* also by other groups of bacteria in case of an earlier sampling. At the fish deaths water samples were withdrawn also from the water of the Körtvélyes channel where the water quality was of IIIrd class "contami nated". On observing the seasonal changes it can be stated that, similarly to the Mártély backwater, the peak values in late falltime can be attributed to the durable stagnancy of the water. The peak values of the *Clostridium* and faecal *Streptococcus* counts were recorded end of May at a lower water level after a flood when the great number of Clostridia may have indicated also the predominance of the anaerobic processes.

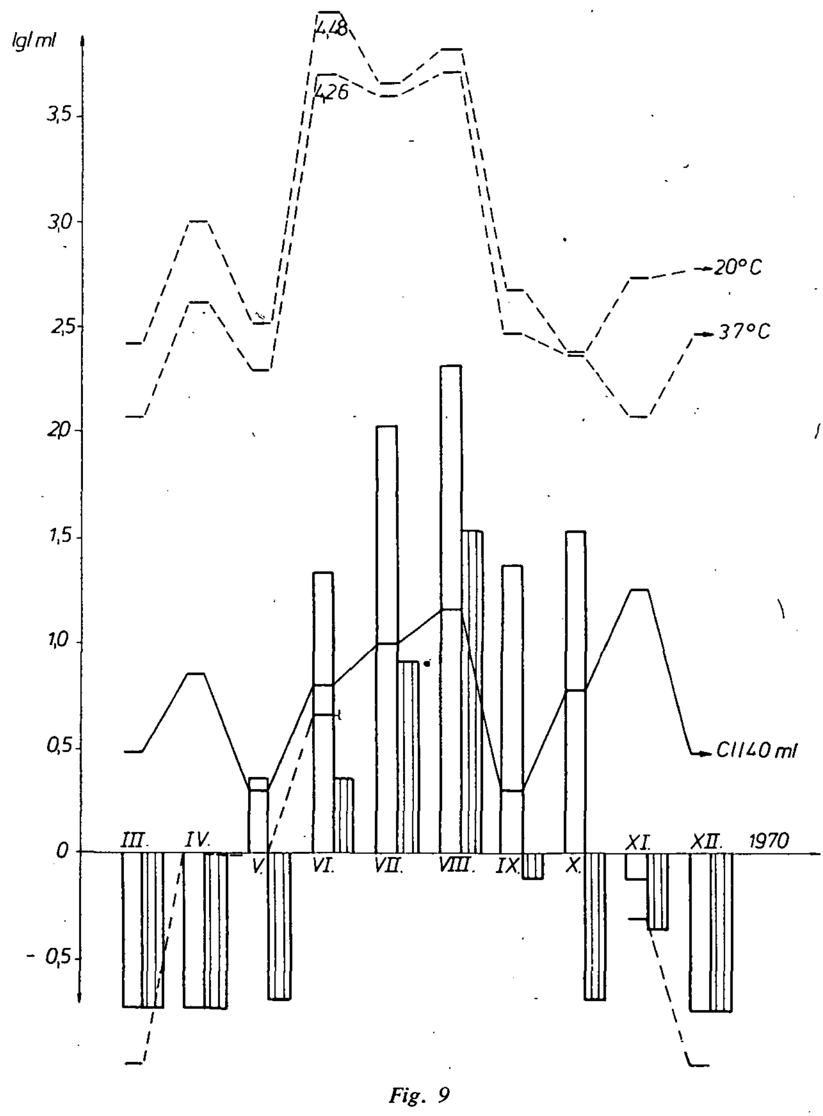


Fig. 9

3. Results of the bacteriological investigations carried out in 1978 (Fig. 9)

50% of the investigated samples was Ist class "pure" water and the other 50% IInd class "slightly contaminated" water, indicating in comparison to the previous years a rather significant deterioration of the water quality. Bacteria belonging to the genus *Salmonella* could be never isolated in any of the water samples of 1000 ml.

The results obtained in 1978 are quite in accordance with the water quality of the Mártély backwater. Changes in the water quality of the Körtvélyes backwater can be also attributed to the factors mentioned there. Namely, the investigated

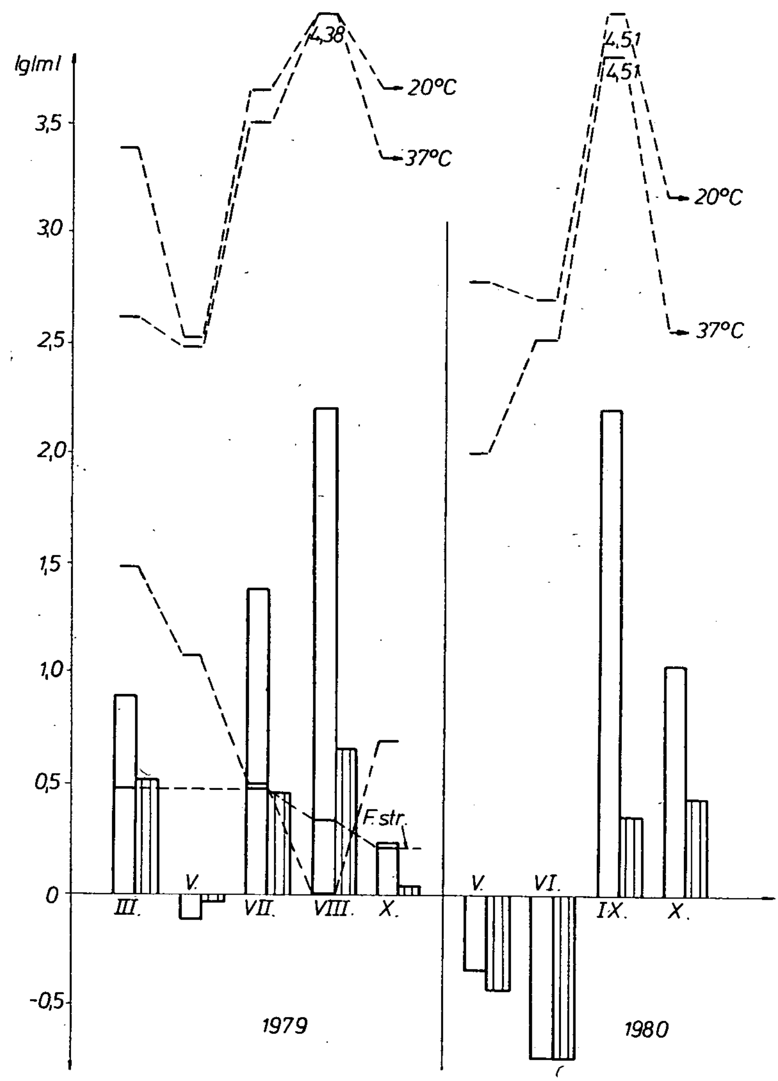


Fig. 10

parameters of hygiene indicated up to the month June a relatively favourable value even at a durably high water level (excepting the values of the *Clostridium* count/40 ml).

Though in June and July the flood-plain of the backwater was still covered with water, the tendency was receding. This was then followed by two smaller floods which were well indicated by the peak values of the counts of the coliform and heterotrophic bacteria. Two further floods (in September and October) were similarly indicated by the values of the coliform counts. In November and December, in turn, the water quality of the backwater was Ist class "pure", and at this time again the character of stagnant water predominated.

4. Results of the bacteriological investigations carried out in 1979—1980 (Fig. 10)

On the basis of the hygienic bacteriological parameters the water quality of the backwater was in both years Ist class "pure" which was characteristic mainly for the first half of the years. The stagnant waters at falltime were of IInd class, due to the

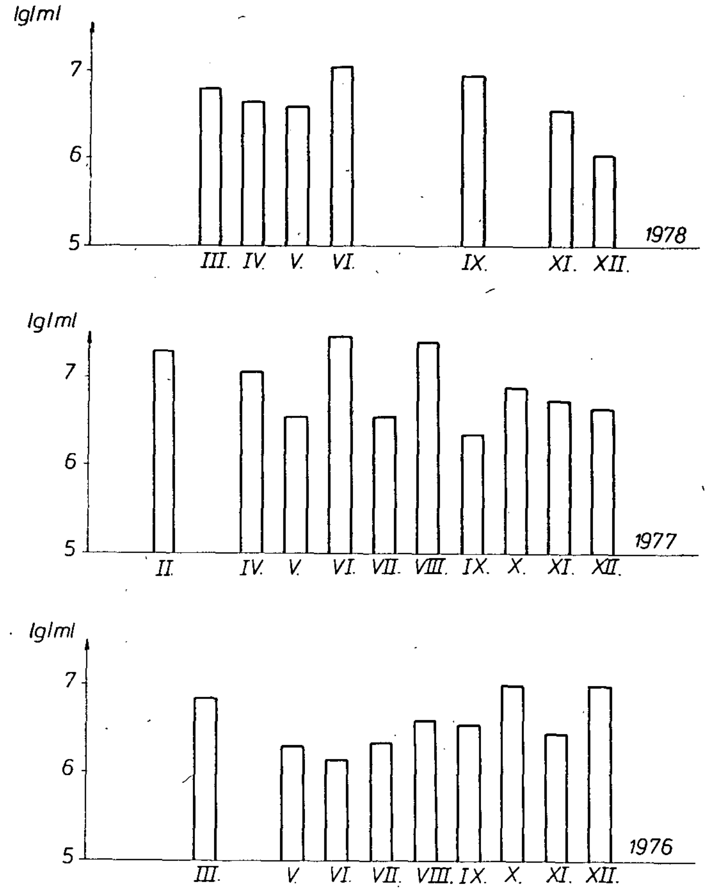


Fig. 11

duality described above, characterizing the water mass of the backwater. Bacteria belonging to the genus *Salmonella* were not detectable in any of the 1000 ml water samples withdrawn during the two years.

5. Results of the investigations of bacterioplankton (Fig. 11)

The direct bacterium count was determined in the water of the Körtvélyes backwater in 1976—1978. During this 3-year period values of 1—10 millions/ml were recorded most frequently in the water of this backwater. Unequivocal correlations

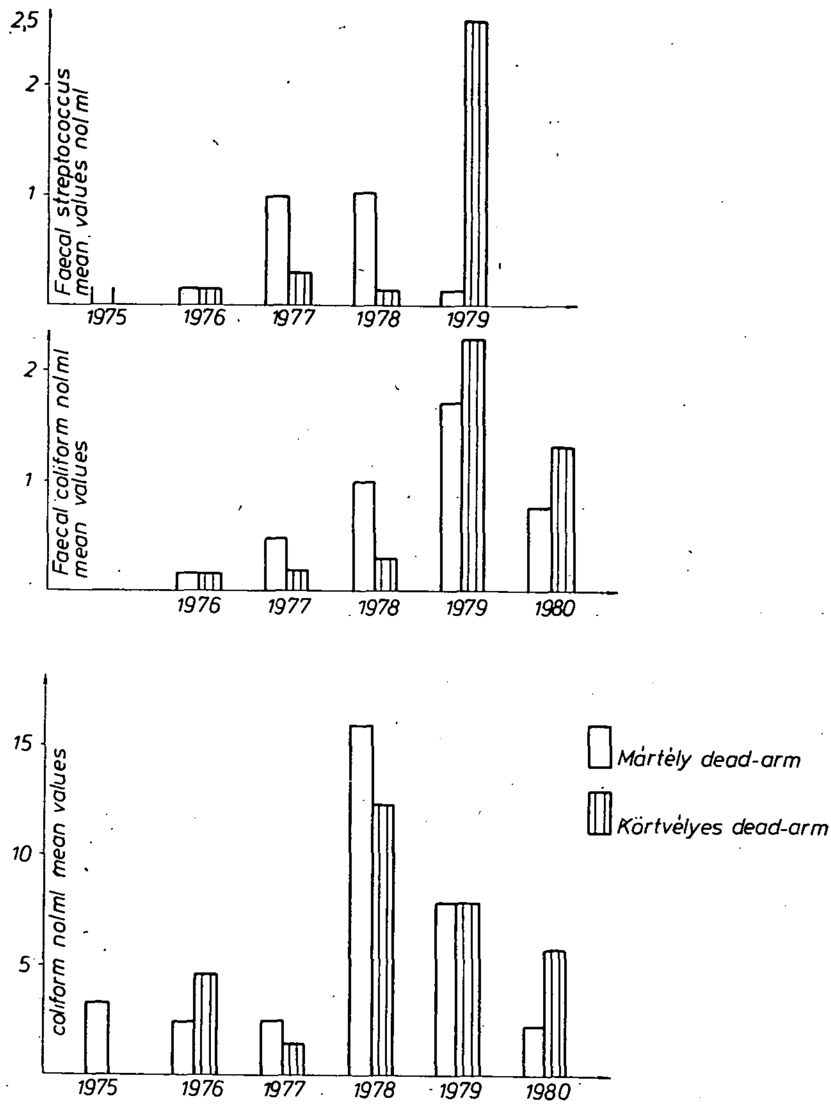


Fig. 12

between the bacterium counts in 20 °C and 37 °C cultures on one hand, and the direct bacterium count, on the other hand could not be detected in the water of the Körtvélyes backwater, either. On the basis of the results of investigations carried out for three years the following can be stated of the changes in the bacterioplankton stand: the quantity of this stand decreases in general in the autumnal season whereas the peak values appear during the floods of river Tisza when the backwater is inundated.

Comparison of the hygienic water quality of both backwaters

The median values of the parameters are shown for each year in a columnar diagram (Figs. 12 and 13) in order to facilitate the evaluation of the changes in each parameter of the water quality of both backwaters.

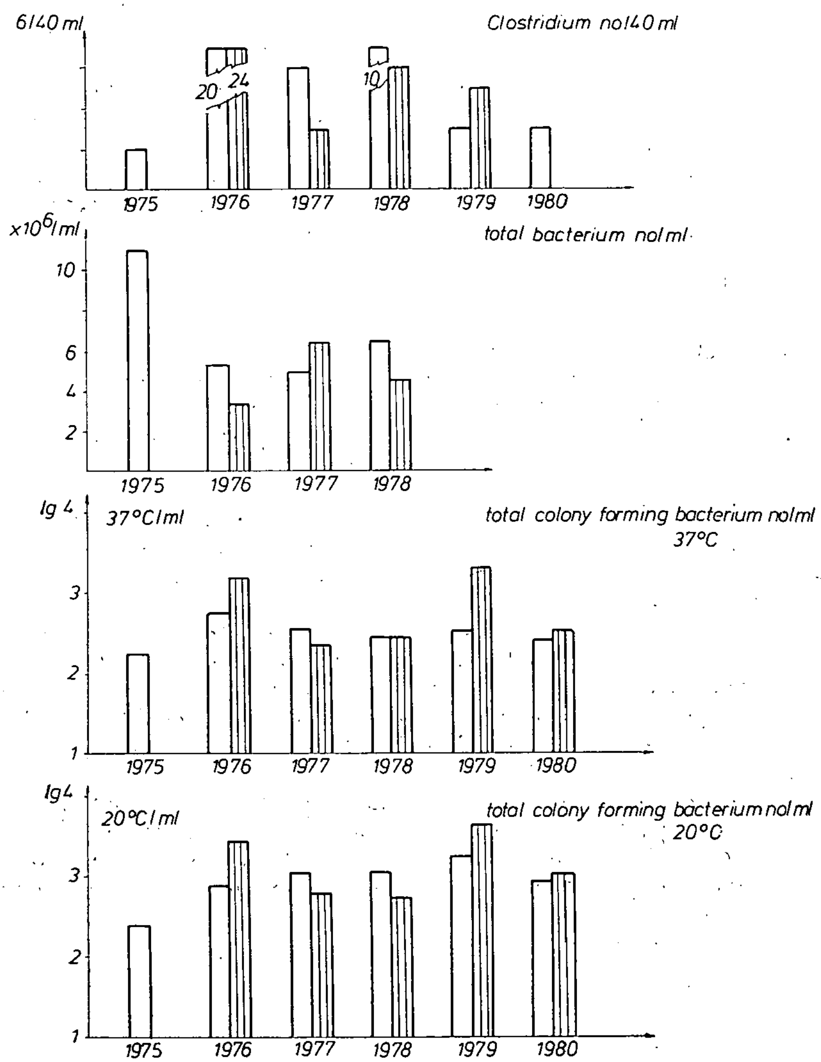


Fig. 13

It can be observed that in 1976 the median values of the investigated bacteriological indicators were higher in the Körtvélyes backwater whereas in the years 1977 and 1978 the median values of almost all the parameters were higher in the water of the Mártély backwater (excepting in 1977 the values of the psychrophilic and the total bacterium counts). In 1979—1980, in turn, the median values of the investigated results disclosed again a change since all the parameters were higher in the water of the Körtvélyes backwater i.e. from an annual aspect the water quality proved less favourable in this water mass.

* * *

The hygienic bacteriological investigation of the waters of the two backwaters in the Mártély Region of Scenery Protection was carried out from 1976 to 1980.

On the basis of the results of these investigations it can be stated:

1. The water of both backwaters is in the majority of cases of Ist class "pure" quality.

2. The obligate faecal indicator bacteria (faecal coliform, faecal *Streptococcus* bacteria and bacteria belonging to the genus *Salmonella*) were detectable only relatively rarely and in small numbers.

3. Of the facultative faecal indicator bacteria the value of the coliform count and the heterotrophic bacterium count indicated well the floods, the rinsing of the sewage lagoons (in the Mártély backwater) and the stagnant water masses developed at high and low waters.

4. The values of the *Clostridium* count/40 ml indicated the stirring-up of the "silt" of backwaters and occasionally the predominance of the anaerobic processes.

5. The value of bacterioplankton/ml varied in the water of both backwaters on average in the order of magnitude of 1—10 millions/ml. During floods their numbers increased and in the autumnal season diminished.

6. The quality of water of both backwaters disclosed a seasonal dynamism which could be observed also on the basis of the hygienic bacteriological investigations.

7. The hygienic water quality of the backwaters Mártély and Körtvélyes is almost identical. The water of the Mártély backwater is utilized also for recreational and bathing purposes which has unfavourable effects on the quality of the water mass since during floods significant amounts of pollutants are entering the backwater.

Occasionally some major faecal contaminations could be detected in the water of the Körtvélyes backwater as well which was indicated also by the change of the ratio of coliform bacteria to the faecal coliform bacteria. The water of the Körtvélyes backwater is contaminated by the rainfall and the sewages of Orosháza, Szentetornya, and of the sanatoria Kakasszék and Kútvölgy, furthermore by the leakage and drainage waters of the paddy-fields.

On summarizing the results of the investigations it can be stated that the hygienic bacteriological investigation of the waters of backwaters is indispensable in solving the actual problems of environmental protection and recreation, furthermore, as a parameter of the biological water qualification it promotes also the development of a uniform contemplation.

References

Adatok a Tisza környezettani ismeretéhez, különös tekintettel a Kisköre vízlépcső térségére (1977) (Data to the environmental knowledge of river Tisza with special respect to the area of the Kisköre barrage). — In Hungarian.

DEÁK, T. and NOVÁK, E. (1969): Kísérletek tervezése és értékelése (Planning and evaluation of experiments). — In Hungarian.

DEÁK, Zs. (1977): Bakteriológiai vizsgálatok a Duna Rajka—Budapest közötti szakaszán (Bacteriological investigations in the Danube reaches between Rajka and Budapest). — Hidr. Közl. *57,* 79—82.

DOBLER, L. and HEGEDÜS, M. (1977): Adatok a Tiszai Tájvédelmi Körzetben levő holtágak vízminőségéhez (Körtvélyesi—Atkai holtág II.) (Data to the water quality of backwaters in the Tisza Region of Scenery Protection. Körtvélyes—Atka backwater II). — Lecture in Hungarian, delivered at the VIII. Conference of Tisza-investigations.

EGYED, B. (1979): Investigation of the problems of land use and environmental protection in the area of the Mártély Region of Scenery Protection. — Thesis in Hungarian, submitted to the University of Agricultural Sciences, Gödöllő.

Ministry of Health — National Office of Water Conservancy (1972): Draft of the Sectoral Standardization of the Quality Evaluation of Surface Waters. — (In Hungarian).

FELFÖLDY, L. (1981): Ecology of waters. — General hydrobiology (in Hungarian).

HAMAR, J. (1976a): Data to the bacteriological and algological conditions of the region of Kisköre River Barrage. — Tiscia (Szeged) *11,* 41—45.

HAMAR, J. (1976b): Bacteriological and algological investigation of the bay at Abádszalók (Kisköre Reservoir). — Tiscia (Szeged) *11,* 85—93.

HAMAR, J. (1976c): Investigation of bacterio- and phytoplankton in the experimental area of Abádszalók at the Kisköre River Barrage. — Tiscia (Szeged) 11. *11,* 111—115.

HEGEDÜS, M. and DOBLER, L. (1976): Hydrobiological investigation of the Mártély backwater. — (Lecture in Hungarian, delivered at the VII. Conference of Tisza-investigations).

HEGEDÜS, M., KISS, P. and BERÉNYI, L. (1979): Salmonellae in the surface waters of Csongrád county. — Tiscia (Szeged) *14,* 25—39.

HEGEDÜS, M., FODRÉ, Zs. and ZSIGÓ, M. (1980): Hygienic bacteriological investigations in the Tisza reaches between Csongrád and Szeged (1975—1978). — Tiscia (Szeged) *15,* 35—44.

HERNÁDI, M. and ROSZTOCZY, E. (1935): Contamination of the rivers Tisza and Maros at Szeged (in Hungarian). — Népegészségügy *16,* 20.

Ivóvíz bakteriológiai vizsgálata (Bacteriological investigation of drinking water). — Hungarian standard MSZ 22 901—71 (in Hungarian).

KAUFFMANN, F. (1975?): Classification of bacteria. Munkagaard, Copenhagen.

A környezetvédelem biológiai alapjai (Biological fundamentals of environmental protection) (1975). In Hungarian. — Budapest.

Módszertani Útmutató a felszíni vizek higiénés bakteriológiai vizsgálatához. — Országos Közegészségügyi Intézet Vízhigiénés Osztály (Methodological Guide to the hygienic bacteriological investigation of surface waters. Published by the National Institute of Public Hygiene, Department of Water Hygiene). — Budapest, 1977.

OLÁH, J. (1973): A bakterioplankton biomasszája és produkciója a Balatonban (in Hungarian). — Hidr. Közl. *53,* 348—358.

OLÁH, J. (1974): Number, biomass and production of planktonic bacteria in the shallow Lake Balaton. — Arc. Hydr. *73,* 193—217.

OLÁH, J. (1975): Analysis of the unusually high stand of bacterioplankton accompanying the fish death in 1975 (in Hungarian). — Halászat *68,* 89.

RAZUMOV, A. S. (1932): Direct count method for bacteria in water. — Mikrobiológia *1*(1), 131—146.

B. TÓTH, M. (1978): Hydrobiológiai tanulmányok a Kiskörei Vízlépcső térségében, valamint a Tisza hossz-szelvényében (Hydrobiological studies in the region of the Kisköre River Barrage and in the longitudinal section of river Tisza) (in Hungarian). (Doctoral dissertation.)

UHERKOVICH, G. (1971): The floating phytoseston of river Tisza (in Hungarian). Szolnok.

VETRÓ, J., KISS, M. and MINDSZENTY, L. (1966): Higiéniai vizsgálatok a Tisza szegedi szakaszán (Hygienic investigations in the Szeged reach of river Tisza). In Hungarian. — Hidr. Közl. *46,* 36.

ZSÍROS, I. (1977): Tisza—Maros—Körös-menti hullámtéri véderdők szerepe a tájrendezésben (Role of shelter forests in the flood-plain along the rivers Tisza—Maros—Körös from the aspect of country planning). — (Diploma thesis for specialized engineers). (in Hungarian).

Higiénés bakteriológiai vizsgálatok a Mártélyi és a Körtvélyesi holt ágak vizéből

HEGEDÜS MÁRIA és ZSIGÓ MARGIT
Csongrád megyei Közegészségügyi-Járványügyi Állomás, Szeged, Hungary

Kivonat

A Mártélyi Tájvédelmi Körzet területe két holtágának vizét az elmúlt öt év alatt rendszeresen vizsgáltuk. A vizsgálatok eredményei alapján következtethettünk az obligát és a fakultatív faecal indikátor baktériumok mennyiségi és minőségi viszonyaira, valamint figyelemmel kísérhettük az esetenként bekövetkező bakteriális szennyezettség tér és időbeli változását is. A két holt ág vizéből 202 mintát vettünk és 910 vizsgálatot végeztünk el.

Eredményeink a következők:

— Mindkét holtág vize az esetek többségében I. osztályú "tiszta" vízminőségű volt.
— Az obligát faecal indikátor baktériumok csak ritkán és kis számban voltak ki mutathátók.
— A fakultatív faecal indikátor baktériumok mennyiségi változása jól jelezte az áradásokat, a szennyvíz-szikkasztók kimosását (Mártélyi holt ágnál) és a magas, valamint alacsony vízállásnál kialakult pangó víztereket.
— A két holt ág vízminősége a higiénés bakteriológiai vizsgálatok eredményei alapján is megfigyelhető évszakos dinamizmust mutatott.

Bakteriološko-zdravstvena ispitivanja vode mrtvaja Mártély i Körtvélyes

HEGEDÜS MÁRIA i ZSIGÓ MARGIT
Zdravstveno-epidemiološka stanica županije Csongrád, Szeged, Hungaria

Abstrakt

Za proteklih pet godina vršena su redovna ispitivanja vode naznačene dve mrtvaje na području zaštićenog okruga Mártély. Rezultati naših ispitivanja ukazivali su na kvantitativne i kvalitativne vrednosti obligatornih i fakultativnih faecal-indikatornih bakterija. Takodje su registrovana i povremena bakteriološka zagadjenja u prostornom i vremenskom aspektu.

Rezultati 910 analiza 202 uzoraka vode mrtvaja su sledeći:

— Vode obe mrtvaje u većini slučajeva pripadaju I. kategoriji.
— Obligatorne faecal-indikatorne bacterije se javljaju sporadično i u malom broju.
— Promenljiva količina fakultativnih feacal-indikatornih bakterija je u direktnoj vezi sa visokim vodostajem, sa isušivanjem bazena za otpadne vode (kod mrtvaje Mártély) kao i sa baruštinama koje se javljaju pri visokim i niskim vodostajima.
— Rezultati zdravstveno-bakterioloških analiza ukazuju na sezonski dinamizam promena kvaliteta vode obe mrtvaje.

ГИГИЕНИЧЕСКО-БАКТЕРИОЛГИЧЕСКИЕ ИССЛЕДОВАНИЯ ВОДЫ СТАРИЦ МАРТЕЛЙ И КЁРТВЕЙЕШ

М. Хегедюш и М. Жиго
Чонградская медико-эпидемическая станция
Сегед, ВНР

Резюме

В заказнике Мартей, умеются две старицы (Мартей и Кёртвейеш), воды которых в последние пять лет систематически изучались нами.

На основании результатов исследований удалось показать качественные отношения облигатных и факультативных индикаторов бактерии фекалий, а также внимательно проследите за изменением пространства и времени бактериальной засоренности.

Из воды двух стариц взяли 202 образца и привели 910 исследований.

Исследования показали слдующие результаты:

— Воды обоих стариц, в большинстве случаем, характеризуются чистотой первой степени.

— Облигатный индикатор бактерии фекалии только изредка появлялся в небольшом количестве.

Количественные смены факультативных индикаторов бактерии фекалии хорошо сигнализировало наступающих наводнениях вымывании сточных вод (старицы Мартейи), а также возникших в будущем площади водных застоев при низких и высоких уровнях воды.

— На основании результатов гигиенически-бактериологических исследований воды, качество обоих стариц показали сезонную динамику.

Tiscia (Szeged) Vol. XVII, pp. 51—65 (1982)

THE ALGAL FLORA AND ITS SEASONAL ASPECTS IN THE KÖRTVÉLYES AND MÁRTÉLY BACKWATERS OF THE TISZA

I. KISS

Department of Botany, Attila József University, Szeged
(Received September 5, 1981)

Abstract

In the Körtvélyes and Mártély backwaters of the Tisza the algal flora was studied during several periods. The water of both backwaters is eutrophized, particularly in the Körtvélyes one. It is well seen in Table I, that since 1981 the number of Euglenophyta spp. has been relatively great in the backwater Körtvélyes, suggesting that the waste waters discharged there contained dung materials. Changes in the composition of the phytoplankton are also in support of the afct that the algae do not utilize only mineral salts, but also amino acids, carbohydrates, vitamins of decomposing organic materials as well as plant hormones. This should be also considered when establishing the indicator value of algae. Saprobity and trophity are mutually related not only because the organic materials producing saprobity increase trophity, but also because the algae are able to directly incorporate some of the organic materials. Mixotrophy can also exhibit differences within one species. The consideration of these facts may be of help in the evaluation of indicator organisms and through that in the accomplishing of a more real biological water qualification.

Introduction

The algal flora of the Körtvélyes and Mártély backwaters of the Tisza river habe been studied for several years. These examinations were started in the backwater at Mártély in 1953—1954. The reason for choosing this place was not only its easy approachability but also the fact that this nice place had been used also earlier as a holiday resort. Since this area together with the backwater Körtvélyes was placed under nature conservation control, the two backwaters and their environment are known today by the name Mártély nature conservation area. Since 1973 the studies on the changes of the algal flora have been extended over the backwater Körtvélyes. The analysis of the algal flora of the backwater Mártély was performed by myself from 1953 to 1954, from 1966 to 1968, from 1972 to 1975 and since 1981. The phytoplankton of the backwater at Mártély was studied by UHERKOVICH from 1967 to 1968 in connection with the thorough investigations performed for a longer period on the algae of the Tisza river and its tributaries (UHERKOVICH 1967a, b, 1971).

In addition to the results of basic research, the experiences obtained can be also very useful in regard of environmental protection, particularly in the field of biological water qualification. This applies especially to the Körtvélyes backwater. In biological water qualification the use of algae as indicator organisms can complement resp. support the results of the chemical qualification of water, and can also furnish us with valuable information from other aspects, too. Nevertheless, the investigations with algae as indicator organisms should be placed on plant physiological foundations and in this regard particular emphasis must be laid on the full knowledge of the forms and possibilities of nutrition af algae, namely, not only the nutritional role of inorganic compounds, cations and anions dissolved in the water should be taken into consideration, but also such results according to which the algae are able to take up and incorporate certain organic compounds of decomposing materials which get into the water as pollutants. We think that this fact has not been given to date the deserved attention in the evaluation of indicator organisms, and through that in the biological qualification of waters, albeit this deficiency may have been the source of many problems. It seems that the differences in opinion in connection with algal indication are occasionally resolved just by the contradictory ideas, and more thorough investigations in this line.

Not only the cations and anions of inorganic compounds serving as food for plants represent the direct source of eutrophication in our natural waters. It has become increasingly evident that the incorporation by algae of some organic compounds polluting the waters results in the rapid enrichment of the algal vegetation. This phenomenon could be clearly observed in the Mártély backwater, especially in the Körtvélyes one. Therefore, in the following we shall deal with the stimulating effect of these organic materials in a greater detail in connection with analysis of the phytoplankton of the two backwaters.

Material and Method

It is not possible to give space in this paper to the detailed presentation of the vast material on the algal flora. Therefore, the initial and the last conditions will be compared in a tabulated form for illustrating the seasonal changes of phytoplankton (Table 1). In the table the seasons are marked with letters: a = spring, b = summer, c = autumn. The taxonomic determination of algae was made in living condition, while fixed material was used for the study of the quantitative relationships. The relatively simple "drop method", developed by us earlier, was used to reveal the quantitative relationships of the phytoplankton. The course of this process is the following: from the sedimented seston of each liter fixed material, a concentrate of 10 ml was prepared. After thorough shaking, one drop was taken from this concentrate with a standard pipette for wet preparation the volume of which was 50 mm^3 on the average. The quantitative relationships of each water sample were determined on the basis of 10 wet preparations with 5 grades. The grades 1—5 figure in the seasonal columns (a, b, c) of Table I and their meaning is the following: 1 = rare organism in the water sample (only 1—5 specimens occurred in the 10 preparations). 2 = sporadic occurrence (in 10 preparations only 6—10 individuals were visible), 3 = frequent occurrence (there) were a few individuals in a single preparation), 4 = very frequent occurrence (several individuals (15—20) were found in a single preparation), 5 = mass production of bloom (the water possessed a grean colour due to the great number of organisms). This method is relatively rapid and the first two grades can be expressed with approximate value in terms of liter. Since the volume of the drop. resp. the wet preparation is known, concrete counting is also possible by good approximation beyond the former grades and reckoning over into liter is also possible. In the case of filamentous algae, the quantitative grades were determined by estimation on the basis of the number of places of collection, the area of extension of the particular population and the density of the filaments.

Results and discussion

During the investigations performed in the Mártély and Körtvélyes backwaters of the Tisza for several years, the presence of 212 algal taxa (species, or their variations and forms) were established. The two backwaters are very near to each other on the left bank of the Tisza, and therefore did not exhibit great differences in the systematic composition of their algal flora. Both of them are in the flood area inside the bank, and in the period of flood are inundated, their beds are practically "flushed", and the greatest part of their water exchanged by the water of the Tisza. This produces such interactions in the biota here which are not yet clearly understood. Both backwaters have eutrophized: the Mártély one gradually, the Körtvélyes one rapidly. Because of that, algal mass productions have been observed in both of them. In the backwater Mártély the massive bloom of Eudorina elegans was observed during summer 1968 and 1973 (Kiss 1977a), and in smaller areas the water possessed a green colour in summer 1979 due to the bloom of *Chlamydomonas intermedia.* In late autumn, 1973, in the littoral zone of the backwater Körtvélyes, Scenedesmus ecornis produced a vegetational discoloration of water vegetation and showed considerable morphological variability (Kiss 1977b).

Table I presents the following picture in connection with the qualitative and quantitative changes of phytoplankton:

1. In each listed seasonal sample taken from both backwaters, the following algae were present: *Aphanizomenon flos-aquae, Caloneis amphisbaena, Tetraedron muticum, Dictyosphaerium pulchellum, Scenedesmus acuminatus, Tetrastrum staurogeniaeforme, Actinastrum Hantzschii, Cladophora fracta.* The seasonal tolerance and the tolerance of environmental factors are obviously very great with these species, and their sociability is also the greatest under the given conditions. There were, however, some algae which occurred only in one of the two backwaters. The following species were missing from the backwater of Mártély: *Lyngbya saxicola, Euglena charkowiensis, Euglena chlamydophora, Lepocinclis Steinii, Phacus helicoides, Phacus tortus, Trachelomonas crebea, Trachelomonas granulosa, Trachelomonas intermedia Trachelomonas verrucosa, Strombomonas verrucosa* var. *genuina, Strombomonas Deflandrei, Centritractus belonophorus, Centritractus rotundus, Nitzschia hungarica, Nitzschia palea, Lagerheimia wratislaviensis* var. *mixta, Golenkinia radiata.* From the Körtvélyes backwater, however, only two species were missing: *Phormidium molle* and one *Gongrosira* sp. These differences of occurence cannot be said to have been essential in regard of the quality of the algal flora, since they just point to the fact that the majority of the species was identical in the two backwaters (of the 212 taxa 192 were common). After all 210 taxa occurred in the Körtvélyes backwater and in the Mártély one 194. This is not a great difference.

2. On the other hand, the numerical differences will become very great when comparing the initial period of these studies with the observations in 1981. We can see the very surprising phenomenon, that in the Körtvélyes backwater the algal flora enriched rapidly during a period of not quite ten years, and instead of the 84 species observed in 1973, 193 species occurred in 1981. In the backwater of Mártély, on the other hand, 148 algal species occurred in 1953, and this number increased only to 179 during a period of almost three decades, i.e. by 1981. This increase looks small relative to that in the Körtvélyes backwater, where the considerable enrichment was connected with the twofold resp. manyfold increase in the number of species of each phylum, with the exception of Cyanophyta. During the 9 years from 1973 to 1981 e.g. the number of green algal species increased from 40 to 100, the number of species belonging to Euglenophyta from 4 to 45, i.e. elevenfold. Doubling occurred in the phyla Chrysophyta and Pyrrophyta, as well.

3. Compared with the increase of species number of the four aforementioned phyla, the number of the species of Cyanophyta decreased to one third. During 1981 only 5 species could be recovered from the 16 ones. *Aphanizomenon flos-aquae* was

frequent in the water samples taken in spring and autumn, and proved to be very frequent in the summer samples. *Anabaena spiroides* occurred only in summer and autumn, *Spirulina laxissima, Oscillatoria planctonica* and *Lyngbya limnetica* only during summer. This decreased frequency of the phylum Cyanophyta is difficult to explain. It is likely that the increase of Euglenophyta or some environmental factor promoting it inhibited the growth of the disappeared Cyanophyta spp. Nevertheless, *Aphanizomenon flos-aquae* proved to be tolerant of this inhibiting factor, too.

4. The above-mentioned increase of Euglenophyta deserves our attention not only because with it the whole picture of the algal population changed, but also from the aspect of the physiology of nutrition of Euglenophyta spp. This latter severely affects the question of biological water qualification in regard of algal indication. It should be stressed first of all that, according to Table 1, the 4 species of Euglenophyta observed during summer 1973 occurred only sporadically near the inflow of the sewer, and were not to be found at the basic point of samplings, in the direction of the landing-stage and the places where the meterological instruments were planted. By 1981 this difference ceased, the algal flora was practically identical in each place of collection. Since 1973 pollution has shown an increasing tendency. Since 1930 it could be observed that the mass growth of algae was greatly enhanced by the stimulating organic materials polluting the water. In alkaline waters ("sodaic waters") of high salt concentration and high pH value, too, there was a surprisingly rich and varied Euglenophyta vegetation if decomposing materials e.g. dung water was discharged into the water (KISS 1939, 1942, 1968, 1970a, b, c, 1972—1975, 1976). It seems that these organic materials are not directly nutrients only, but can also exert a "protecting function" against the damages which may be caused by high salt concentration, resp. high values of osmosis and alkalinity. Only later have we obtained knowledge of the fact that Välikangas had also observed a similar phenomenon in Finland: the ice in the Helsinki harbour and the brackish water underneath were discoloured by *Euglena viridis*. This phenoumenon occurred, however, only in the place of discharge of metropolitan sewage (VÄLIKANGAS 1921—22). The *Euglena viridis* is an eurytherm organism which, in the presence of stimulatory compounds, is able to form mass-productions even during the winter.

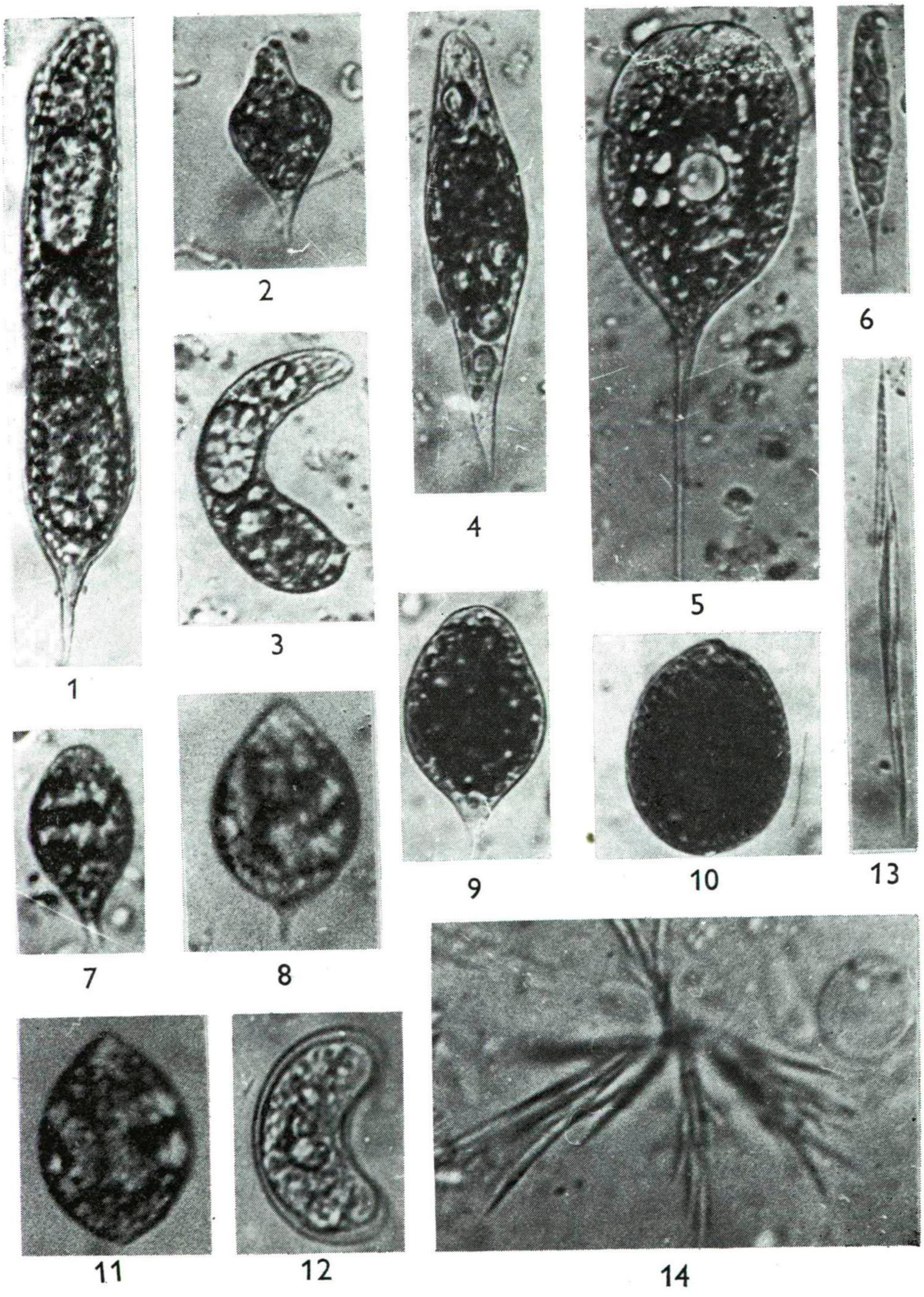
5. Physiological experiments performed with algae suggested that these stimulating materials might be protein constituents, amino acids, vitamins or hormones, which were utilized and incorporated particularly by the members of the phylum Euglenophyta. To study the grwoth and reproduction processes of *Trachelomonas crebea,* pea brew nutrient solution was prepared in 1935 to which some lemon juice was added. On the effect of the medium containing vitamin C and much organic

Plate I

1. *Euglena oxyuris* var. *minor* DEFL. 700:1
2. *Euglena pisciformis* KLEBS 800:1
3. *Euglena charkowiensis* SWIRENKO 700:1
4. *Euglena thinophila* SKUJA 1000:1
5. *Phacus longicauda* (EHR.) DUJ. 600:1
6. *Euglena chlamydophora* MAINX 800:1
7. *Lepocinclis acuta* PRESC. 900:1
8. *Lepocinclis ovum* (EHR.) LEMM. 900:1
9. *Lepocinclis texta* var. *mamillata* (DA CUNHA) CONR. 700:1
10. *Lepocinclis texta* (DUJ.) LEMM. 600:1
11. *Lepocinclis fusiformis* (CARTER) LEMM. 800:1
12. *Nephrochlamys allanthoidea* KORS., forma 1500:1

13—14. *Ankistrodesmus acicularis* (A. BRAUN) KORS. 800:1

Plate I



nitrogen, the cell division of *Trachelomonas* took place also in the naked form through several generations. The young cells sometimes did not separate from one another but remained joined at their basal parts, producing bicellular pseudocolonies. In some cases the cells of the two-celled pseudocolonies. In some cases the cells of the two-celled pseudocolony divided again and produced four-celled pseudocolony. We succeeded in transforming the unicellular alga into multicellular forms at a later date, too (KISS 1939, 1960, 1973). This finding is believed to be the result of increased nutrition and accelerated cell division. In his excellent book PÉTERFI (1977) also refers to the facultative heterotrophy of flagellates and their vitamin C auxotrophy. He claims that in his experiments the filamentous green alga Microthamnion grew well on glucose medium even in complete darkness. He also mentions the results obtained by MIHNEA et al. according to which the organic materials added to the medium enhanced protein and carbohydrate synthesis of a few unicellular algae and stimulated cell division both in light and darkness. According to the investigations performed by UHERKOVICH (1956), *Scenedesmus quadricauda* exhibited very intensive growth in a medium of optimal mineral salt content when vitamin B_1 was added to the medium, and produced large cells on the effect of vitamin PP and broad cells in vitamin B_6-containing medium. Larger doses of vitamin B_1 inhibited cell division. He also observed that some *Scenedesmus* strains isolated by FELFÖLDY and KALKÓ did not react in the same way to the addition of aneurin (UHERKOVICH 1965). KESSLER and CZYGAN (1970, 1972) examined 71 strains of 8 autotrophic species of *Chlorella* in regard of the utilizability of 5 organic nitrogen compounds. They stated that in light the use of glutamine acid produced good growth in the case of 63 strains, while that of glutamine good growth in the case of 67 ones. Purine was utilized in growth by 16 strains, nicotinic acid amid by 9 strains and nicotinic acid only by one strain. The possibility of utilization of 6 organic carbon sources was also examined. In darkness good growth was observed following acetate addition in the case of 72 strains belonging to the 10 autotrophic species of *Chlorella* and following glucose addition in the case of 37 strains belonging there. Utilization of fructose was satisfactory with 21 strains, that of galactose with 11 strains, while in the case of saccharose and lactose intensive growth was not evident. The organic compounds investigated were utilized readily by some strains by others less readily, meaning that utilization was selective. Of the plant hormones, auxin is the most important in regard of Körtvélyes, because it is present in a great quantity in animal dungs. It is not species specific and is effective only in optimal quantity, in higher concentrations it is inhibitory. Its role may change according to the type of alga, indicating that selectivity applies to it, as well.

The few examples presented here from among the many data, basically affect he question of saprobity-trophity possessing a key position in biological water

Plate II

1. *Pandorina charkowiensis* KORS. 1000:1
2. *Pandorina morum* (MÜLLER) BORY forma 1000:1
3. *Eudorina cylindrica* KORS. 700:1
4. *Tetraedron proteiforme* (TURN.) BRUNNTH. 500:1
5. *Pediastrum simplex* MEYEN 500:1
6. *Crucigenia tetrapedia* (KIRCHN.) W, et G.S. West 600:1
7. *Oocystis Marssonii* LEMM. 800:1
8. *Pediastrum tetras* (EHR.) RALFS 1000:1
9. *Strombomonas verrucosa* var. *zmiewika* DEFL. 600:1
10. *Dictyosphaerium pulchellum* WOOD 700:1

Plate II

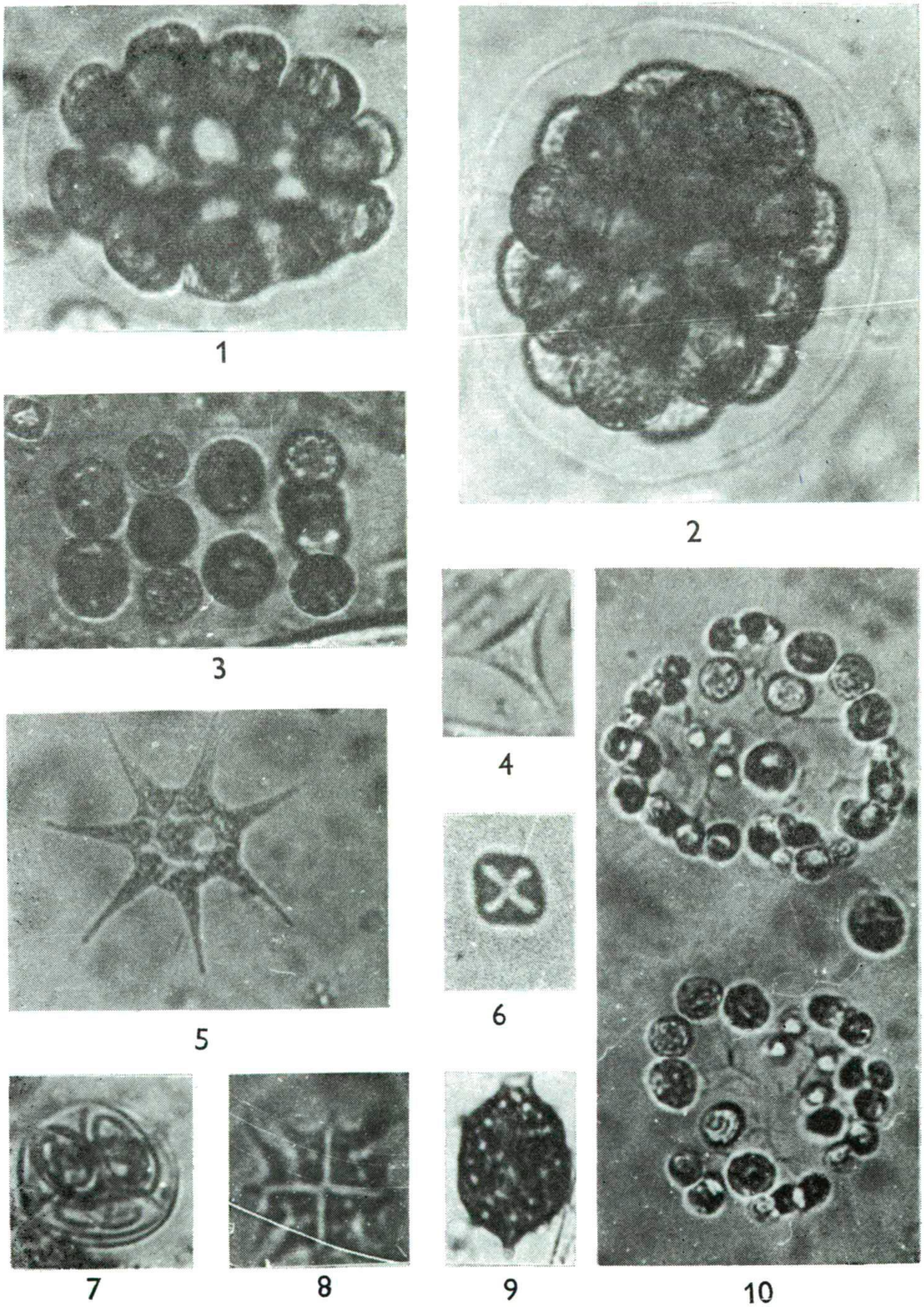


Table 1

Sor-szám	Species (taxon)	Körtvélyes						Mártély					
		1973			1981			1953			1981		
		a	b	c	a	b	c	a	b	c	a	b	c
	Phylum: Cyanophyta												
1.	*Gomphosphaeria aponina* KÜTZ.	1	3	2					2	2		2	
2.	*Merismopedia glauca* (EHR.) NAEG.	1	3	2					2				
3.	*Dactylococcopsis raphidioides* HANSG.	2	3	3				1	2	2			
4.	*Aphanizomenon flos-aquae* (L.) RALFS	2	4	4	3	4	3	2	4	3	3	4	3
5.	*Anabaena spiroides* KLEBAHN	2	4	4		2	1	1	3	2		3	2
6.	*Spirulina laxissima* G. S. WEST	1	2			3			2	2		2	
7.	*Sp. subtilissima* KÜTZING	1	2	2				2	2	3		2	
8.	*Oscillatoria angustissima* W., G.S. WEST		2						1	2	1	2	
9.	*O. plantonica* WOLOSZ.	2	3	3		2			2	1	1	2	1
10.	*O. tenuis* AGARDH	2	3	1				1	2	1			
11.	*Phormidium foveolarum* (MONT.) GOM.	2	3	3				1	2	2		2	
12.	*Ph. molle* (KÜTZ.) GOM.							2	2	2		1	
13.	*Lyngbya bipunctata* LEMM.		2	2				1	2	1		2	
14.	*L. circumcreta* G.S. WEST	2	2						2	2			
15.	*L. limnetica* LEMM.	2	3	3		2			2	2		2	1
16.	*L. Martensiana* MENEGH.	2	3	2					3	4			
17.	*L. saxicola* FILARSZKY	1	2										
	Phylum: Euglenophyta												
1.	*Euglena acus* EHRENBERG				2	3	1		2	1		2	2
2.	*E. charkowiensis* SWIR.				2	3	2						
3.	*E. chlamydophora* MAINX				1	2	2						
4.	*E. Ehrenbergii* KLEBS		2		1	3	2			2		2	1
5.	*E. limnophila* LEMM.				2	3	1				1	2	1
6.	*E. oxyuris* var. *minor* DEFL.				3	3	3		2		1	2	2
7.	*E. pisciformis* KLEBS				2	3	1				1	1	
8.	*E. polymorpha* DANG.				2	3	2		2		2	2	2
9.	*E. proxima* DANG.				1	2	2				1	2	
10.	*E. oblonga* SCHMITZ				1	3	1				2		
11.	*E. thinophila* SKUJA				1	2			1	2	2	2	1
12.	*Lepocinclis acuta* PRESC.		2		1	2	2	1	2		2	3	2
13.	*L. fusiformis* (CARTER) LEMM.		2		2	3	2		1	2	1	1	
14.	*L. Nayali* CONRAD				1	3	2		2	1		2	
15.	*L. ovum* (EHR.) LEMM.		2		1	3	2	1		2	2	3	1
16.	*L. ovum* var. *angustata* (DEFL.) CONR.				1	2			2	2		1	
17.	*L. Steinii* LEMM.				2	2							
18.	*L. teres* (SCHMITZ) FRANCÉ				2	3	2			2	2	3	2
19.	*L. texta* (DUJ.) LEMM.				1	3	2		2			2	
20.	*L. texta* var. *mamillata* (CUN.) CONR.				1	3	1			1		1	
21.	*Phacus acuminatus* STOKES				1	2					1	2	
22.	*Ph. alatus* KLEBS				2	2	1		2		1	2	
23.	*Ph. brevicaudatus* (KLEBS) LEMM.				1	2					1	2	
24.	*Ph. caudatus* HÜBNER				1	2	1				1	2	
25.	*Ph. curvicauda* SWIR.				1	2	1		2		1	1	
26.	*Ph. longicauda* (EHR.) DUJ.				2	3	2		1	1	1	2	
27.	*Ph. helicoides* POCHMANN				1	2	1						
28.	*Ph. tortus* (LEMM.) SKWORTZ.					2	2						
29.	*Trachelomonas angustata* DEFLANDRE					1	2		2			2	
30.	*Tr. conica* PLAYFAIR				1	2	1			2		2	
31.	*Tr. crebea* KELLICOTT					1	2						
32.	*Tr. Dybowskii* DREZ.					2	2					2	

Species (taxon)		Körtvélyes						Mártély					
		1973			1981			1953			1981		
		a	b	c	a	b	c	a	b	c	a	b	c
33.	*Tr. granulosa* PLAYF.				1	2	1						
34.	*Tr. hispida* (PERTY) STEIN				1	1			2			2	
35.	*Tr. intermedia* DANGEARD				2	2							
36.	*Tr. Mangini* DEFL.				1	2			2		2		
37.	*Tr. oblonga* var. *truncata* LEMM.				1	2			2		2		
38.	*Tr. scabra* PLAYF.				1	3	2		2		1	3	1
39.	*Tr. verrucosa* STOKES				2	2							
40.	*Tr. volvocina* EHR.				3	3	3	1	2		3	3	3
41.	*Tr. volvocina* var. *derephora* CONR.				2	3	2			2		2	1
42.	*Strombomonas fluviatilis* (LEMM.) DEFL.				1	3	2			2		2	
43.	*Str. verrucoca* var. *genuina* DEFL.				1	2							
44.	*Str. verrucosa* var. *zmiewika* DEFL.				1	3	2					2	
45.	*Str. Deflandrei* (ROLL) DEFL.				2	1							
	Phylum: Chrysophyta												
	Classis: Chrysophyceae												
1.	*Kephyrion Rubri-claustri* CONR.					1	2		2	1		2	2
2.	*Chrysococcus rufescens* KLEBS				1	2			1	3		2	
3.	*Pseudokephyrion conicum* SCHILLER		2	3	1	3	1		2		1	3	2
4.	*Dinobryon divergens* IMHOF	2	2	1	2	1			2	2	1	2	1
	Classis: Xanthophyceae												
5.	*Characiopsis acuta* BORZI				1	2	1	2	2		2		
6.	*Ch. minor* PASCHER					1	1		3				
7.	*Centritractus belonophorus* LEMM.				1	3	2						
8.	*C. rotundus* PASCHER				1	2							
9.	*Ophiocytium capitatum* WOLLE				2	3			2	1		2	2
10.	*Tribonema aequale* PASCHER				2				3			2	
11.	*Tr. minus* (WILLE) HAZÉN		2		2			3	1		3		
12.	*Tr.* species				2	2	1	3					
13.	*Vaucheria* species		2		2	3	2	2			2	3	
	Classis: Bacillariophyceae												
14.	*Melosira varians* C.A. AG.				2			1	2			2	
15.	*M. granulata* var. *muzzanensis* (MEISTER) BETHE		1		2	3		2	2		2		
16.	*Attheya Zachariasi* J. BRUN.	2	2		1	2		1	2			2	
17.	*Cyclotella Kuetzingiana* THWAIT.		1		1	2		1	1	2	2		
18.	*C. Meneghiniana* KÜTZ.		2		2	3	2	2	2	1	2	2	2
19.	*Diatoma vulgare* BORY		2	2		2		2	2			2	
20.	*Fragilaria capucina* DESMAZ.					1	1	2	2				2
21.	*Asterionlella formosa* HASSALL		1		1	2			2		2	2	
22.	*Synedra actinastroides* LEMM.		2		2	2		2	2		2	2	
23.	*Syn. acus* (KÜTZ.) HUST.					2		1	2			2	1
24.	*Syn. affinis* KÜTZING				1	1		1	1		2	2	
25.	*Eunotia praerupta* var. *inflata* GRUN.				2	2	1	1				2	
26.	*Gyrosigma acuminata* (KÜTZ.) RABH.		2		1	2	1	1	3	2	2	3	2
27.	*Caloneis amphisbaena* (BORY) CLEVE	2	2	2	2	3	2	2	3	3	2	3	2
28.	*Navicula cincta* (EHR.) KÜTZ.				1	2		2	1				
29.	*N. cryptocephala* KÜTZ.		1		2	1		1	2		1		2
30.	*Amphora venata* (KÜTZ.) HUST.			1	2	2	1	1	2			2	
31.	*Cymbella affinis* KÜTZ.			2	1	2			2		1	2	
32.	*C. cymbiformis* (AG.) KÜTZ.		1	1		2		1	2		1		
33.	*C. cistula* (HEMPR.) GRUN.				2	1		1					2
34.	*Gomphonema acuminatum* EHR.		2	1	2	2	1		3	2	2	2	
35.	*G. augur* EHRENBERG			1	2	2	1	2	2			2	

	Species (taxon)	Körtvélyes						Mártély					
		1973			1981			1953			1981		
		a	b	c	a	b	c	a	b	c	a	b	c
36.	*Nitzschia acicularis* W. Smith				1	2		1	2			2	1
37.	*N. capitellata* Hust.				2	2			2	1	1		
38.	*N. hungarica* Grunow		2	2									
39.	*N. palea* (Kütz.) W. Smith			2	2	2							
40.	*Cymatopleura solea* (Bréb.) W. Smith	1			3	3	1	3	2	1	1	3	2
	Phylum: Pyrrophyta												
1.	*Glenodinium pulvisculus* (Ehr.) Stein		1		2	2		1	2		2		
2.	*Peridinium cinctum* (O.F.M.) Ehr.				1	2		2					
3.	*P. palatinum* Lauterborn				1	1		1	2		1		
4.	*Ceratium hirundinella* (Müll.) Schrank		2	1	2	3	2		1	2	2	3	1
	Phylum: Chlorophyta Classis: Chlorophyceae Ordo: Volvocales												
1.	*Chlamydomonas intermedia* Chod.				3	3	2	2	3		2	3	1
2.	*Chlamydomonas* spec.				2	3					2	2	
3.	*Carteria* spec.					2				1	2	2	
4.	*Eudorina cylindrica* Kors				2	2		2	3	1	2	2	
5.	*Eudorina elegans* Ehrenberg	1	2		2	3	2	2	2	1	2	3	2
6.	*Pandorina charkowiensis* Kors.				2	4	3			1	2	2	
7.	*Pandorina morum* (Müller) Bory				1	3	2				1	1	
	Ordo: Chlorococcales												
8.	*Tetraedron caudatum* (Corda) Hansg.		1		1	2	1	2	1	1	2	2	2
9.	*T. incus* (Teil.) G.M. Sm.				2	2	2				2	1	1
10.	*T. minimum* var. *apiculatum* Reinsch				1	2	2					2	
11.	*T. muticum* (A. Br.) Hansg.	1	2	1	2	3	2	1	1	1	2	1	2
12.	*T. proteiforme* (Turn.) Brunnth.		1		1	3	2					1	2
13.	*T. trigonum* (Naeg.) Hansg.					2	1		2	1		2	1
14.	*Schroederia setigera* (Schröd.) Lemm.				1	2		1	2		2	2	1
15.	*Characium Naegelii* A. Braun					2	1					1	2
16.	*Oocystis cingulatus* Hortob. et Ném.				1	2	2				1	2	
17.	*O. Marssonii* Lemm.	1			1	2	1		2	2	1	2	2
18.	*O. ovale* Kors.				2	2	1				1	2	
19.	*Chodatella citriformis* Snow				1	1					1	1	
20.	*Ch. ciliata* (Lagerh.) Lemm.				1	1			1	2	1	2	1
21.	*Coenocystis planctonica* Kors.					2	1				1		
22.	*Coe. reniformis* Kors.				1	2					1	2	
23.	*Gloeoactinium limneticum* G.M.Sm.				1	2		1	2		1		
24.	*Lagerheimia Griffithsii* Fott				1	1			2	1			
25.	*L. wratislaviensis* var. *mixta* Hortob.				1	2							
26.	*Franceia droescheri* (Lemm.) Kors.				2				2		1	1	
27.	*Chodatellopsis elliptica* Kors.				1	1					1		
28.	*Nephrochlamys allanthoidea* Kors.		1		2	3	3	2	3	2	2	3	2
29.	*N. subsolitaria* (G.S. West) Kors.				1	2	2	1	2	2	1	1	1
30.	*Kirchneriella contorta* var. *lunaris* Richter		1	1	1	2	1					2	
31.	*K. obesa* (W. West) Schmidle				1	1	2	1	2	1	1	2	1
32.	*Selenastrum Westii* G.M. Sm.				1	2	2				1	2	
33.	*S. gracile* Reinsch					2	1	1	2				
34.	*Ankistodesmus acicularis* (A. Br.) Kors.	1	1		1	3	2		3	2		3	2
35.	*A. angustus* Bern.					2	2		3	2	2	2	2
36.	*A. arcuatus* Kors.					2	2				2	2	
37.	*A. falcatus* (Corda) Ralfs	1	2	1	1	2	2	1	2	1	1	2	1
38.	*A. setigera* (Schröd.) Lemm.					2	1	2	2	3	2	2	2
39.	*Coenocystis planctonica* Kors.				1	1			2	2	1	2	

	Species (taxon)	Körtvélyes						Mártély					
		1973			1981			1953			1981		
		a	b	c	a	b	c	a	b	c	a	b	c
40.	*C. reniformis* Kors.					1	2	1	2		1	2	1
41.	*Micractinium pusillum* Fres.					2	2	1	3		1	2	
42.	*Golenkinia paucispina* W., G.S. West					1	2		2	1			
43.	*G. radiata* Chodat					1	1						
44.	*Golenkiniopsis solitaria* Kors.				2	2					1	2	
45.	*Dictyosphaerium pulchellum* Wood	1	2	1	2	3	2	1	3	2	2	3	2
46.	*Didymocystis planctonica* Kors.					2	1	1	2		1	1	
47.	*Scenedesmus acuminatus* (Lagh.) Chod.	1	1	2	2	3	3	1	2	1	2	3	3
48.	*Sc. acuminatus* f. *maximus* Uherkov.			2	1	2	2	1	2	1		2	1
49.	*Sc. acuminatus* var. *elongatus* G.M. Sm.					2	1				1	2	
50.	*Sc. acutus* (Meyen) Chod.		2	1	2	3	2	1	2			2	2
51.	*Sc. acutus* f. *alternans* Hortob.				1	2	2					2	
52.	*Sc. acutus* f. *costulatus* (Chod.) Uherkov.					1	1					2	
53.	*Sc. arcuatus* Lemm.				1	1		1	2	1	1	2	
54.	*Sc. denticulatus* Kirchn.		2	3	1	3	2				2	2	1
55.	*Sc. denticulatus* var. *linearis* Hansg.				1	2	2		2	3	1	1	
56.	*Sc. dispar* Bréb.				1	1	2		3	2	1	2	1
57.	*Sc. ecornis* (Ralfs) Chod.		1	5	1	2	2	1	2	2	2	2	2
58.	*Sc. ecornis* var. *disciformis* Chod.		2		2	3	2				1	2	1
59.	*Sc. ellipsoideus* Chod.				1	2	2	1	2	1	2	2	2
60.	*Sc. intermedius* Chod.		1	1	1	2	2		3	2	1	2	
61.	*Sc. intermedius* var. *bicaudatus* Hortob.				1	2		1	2	1	2	2	1
62.	*Sc. nanus* Chodat				1	1	1					2	
63.	*Sc. obtusiusculus* Chod.				1	2					2	1	
64.	*Sc. opoliensis* P. Richt.		2		2	3	2				1	3	2
65.	*Sc. tibiscensis* Uherkov.					2	1				2	1	
66.	*Sc. quadricauda* (Turp.) Bréb.		2		2	3	3	2	3	3	2	3	3
67.	*Sc. quadricauda* var. *biornatus* Kiss I.				1	1		1	2		2	2	
68.	*Sc. spinosus* Chodat				2	2	2				2	1	
69.	*Coelastrum microporum* Naeg.			1	1	2	2	1	2	2	1	3	2
70.	*C. pseudomicroporum* Kors.	1	2	1	2	3	3		2	1	2	2	1
71.	*C. sphaericum* Naeg.				1	2				[illegible]	2	3	
72.	*Crucigenia rectangularis* (Naeg.) Gay.				2	2	1	1	1	2	1	2	1
73.	*Cr. tetrapedia* (Kirchn.) W., G.S. West			1	2	3	3		2	1	2	3	2
74.	*Cr. truncata* G.M. Sm.				1	2	2				2	2	1
75.	*Cr. quadrata* Morren					2	1	1	2	2	1	3	2
76.	*Tetrastrum staurogeniaeforme* (Schröd.) Lemm.	1	2	1	2	3	1	2	3	2	2	3	2
77.	*Actinastrum Hantzschii* Lagerh.	1	2	2	2	3	3	1	2	3	2	3	2
78.	*Pediastrum Boryanum* (Turp.) Menegh.		1	1	1		2	1		2	2	2	1
79.	*P. Boryanum* var. *brevicorne* A. Br.				1		1				2	2	1
80.	*P. Boryanum* var. *longicorne* Reinsch					2	1		2	2		2	1
81.	*P. duplex* Meyen				1	2	2	2	2	1	1	2	1
82.	*P. simplex* Meyen				1	2	2	1	3	2	1	2	2
83.	*P. tetras* (Ehr.) Ralfs					2	1				1	2	
84.	*Elakothrix gracilis* Hortob.					2	1				1	2	
	Ordo: Ulotrichales, Oedogoniales, Siphonocladales												
85.	*Uronema confervicolum* Lagerh.		1	2		1	1		2			1	1
86	*Stigeoclonium Huberi* Heer.	1	3	1	2	2	1		1	2	2		
87.	*Gongrosira* spec.							2	3				
88.	*Aphanochaete repens* A. Braun		2									1	
89.	*Oedogonium* spec.					2		2	2	3	2	2	
90	*Bulbochaeta* spec.		2	1				2	2				
91.	*Cladophota fracta* Kg. ampl. Brand	2	2	2	2	3	2	3	3	3	3	3	3

	Species (taxon)	Körtvélyes						Mártély					
		1973			1981			1953			1981		
		a	b	c	a	b	c	a	b	c	a	b	c
	Classis: Conjugatophyceae												
	Ordo: Desmidiales												
92.	*Closterium acutum* Bréb.		2		2	2	1	2	1		2	2	
93.	*Cl. attenuatum* Ehr.				1	1					1		
94.	*Cl. gracile* var. *elongatum* W., G.S. West	2	2		2	2	1	1	2		2	2	
95.	*Cl. strigosum* Bréb.				2	1					1	2	
96.	*Cl. subulatum* (Kütz.) Bréb.					1		1	2		1		
97.	*Cosmarium granatum* Bréb.		2		2			2	2	1	1	2	1
98.	*C. laeve* Rabenhorst	2	1								2		
99.	*C. subtumidum* Nordst.					1			2		1		
100.	*Spirotaenia obscura* Ralfs				1			1	2	1	1		
	Ordo: Zygnemales												
101.	*Spirogyra decimina* (Müller) Czurda	3	2		2			2	3		3		
102.	*Sp. fallax* (Hansg.) Wille	2						2	2		2		
103.	*Sp. insignis* (Hass.) Czurda		2		2			3	2		3		
104.	*Sp. lacustris* Czurda	2				2		2	2				
105.	*Sp. nitida* (Dillwyn) Link		2					1	2				
106.	*Mougeotia laevis* (Kütz.) Archer		1	2		2		2			3		

qualification. These namely do not only suggest that by the mineralization of organic materials causing saprobity trophity increases, but also that the algae — by virtue of their physiological nature — are able to utilize and incorporate directly the decomposing organic materials, amino acids, vitamins, carbohydrates and hormones. It is obvious that these facts should also be considered in the biological water qualification in order to obtain more concrete results. For the sake of a better approach of the real situation, allowance should be made also for the fact that in the utilization of organic materials differences can occur according to intraspecific biotypes and strains with genetically fixed properties can also occur. On the basis of the foregoing it is possible to explain why the individuals of the same species exhibit different behaviour under completely identical conditions. These considerations may help us to better understand the differences of opinion concerning indicator organisms, since even contradictory views can reflect reality.

The more thorough study of the backwaters of the Tisza is very actual today. Hortobágyi was the first (1939, 1941a, b, 1942) to carry out studies in this regard and in his work published in 1939 he reported on the occurrence of 273 taxa in the "Nagyfa" backwater. He has complemented these investigations with further ones, moreover he found also a marine, brackish water algal species there which must have been introduced by migrating birds. Further data can be found in Uherkovich's works (1959, 1961a, b, 1963, 1967a, b, 1971) who extended his studies on the potamophytoplankton of the Tisza on the backwaters of the river, too. It would be most useful to compare the phytoplankton of the backwaters of the Tisza with one another resp. with that of the river itself. This would be essential not only from the aspect of basic research but also fom that of environmental protection.

References

HORTOBÁGYI, T. (1939): A Tisza „Nagyfa"-holt ágának phytoplanktonja qualitatív vizsgálata (Qualitative Untersuchungen des Phytoplanktons des toten Armes "Nagyfa" der Tisza). — Fol. Crypt. *2,* 151—216.

HORTOBÁGYI, T. (1941a): Újabb adatok a Tisza „Nagyfa"-holt ága fitoplanktonjának kvalitatív vizsgálatához. I. (Neuere Beiträge zur qualitativen Untersuchung des Phytoplanktons im toten Theiss-Arme „Nagyfa". I). — Bot. Közlem. *38,* 151—170.

HORTOBÁGYI, T. (1941b): Tengeri moszat az Alföld planktonjában (Meeresalge im Ungarischen Tiefland). — Borbásia nova (Budapest) *5,* 1—2.

HORTOBÁGYI, T. (1942): Újabb adatok a Tisza Nagyfa-holt ága fitoplanktonjának kvalitatív vizsgálatához. II. (Neuere Beiträge zur qualitativen Untersuchung des Phytoplanktons im toten Theiss-Arme Nagyfa" II). — Bot. Közlem. *29,* 271—276.

KESSLER, E., F. C. CZYGAN (1970): Physiologische und biochemische Beiträge zur Taxonomie der Gattung *Chlorella.* IV. Verwertung organischer Stickstoffverbindungen. — Arch. Mikrobiol. *70,* 211—216.

KESSLER, E. (1972): Physiologische und biochemische Beiträge zur Taxonomie der Gattung *Chlorella.* VI. Verwertung organischer Kohlenstoff-Verbindungen. — Arch. Mikrobiol. *85,* 153—158.

KISS, I. (1939): Békés vármegye szikes vizeinek mikrovegetatioja. I. Orosháza és környéke. Die Mikrovegetation der Natrongewässer des Comit Békés. I. Orosháza und dessen Umgebung. — Fol. Crypt. *48,* 217—266.

KISS, I. (1942): Bioklimatológiai megfigyelések az *Eudorina elegans* vízvirágzásában (Bioklimatologische Beobachtungen bei der Wasserblüte von Eudorina elegans). — Acta Bot. (Szeged) *1,* 81—94.

KISS, I. (1960): Verschiedene Formen der inàqualen Zellteilung bei einigen einzelligen Pflanzenarten. — Acta Biol. (Szeged) *6,* 57—70.

KISS, I. (1968): Vízfeltöréses („forrásos") talajfelületek vizsgálata a Dél-Alföld szikes területein, különös tekintettel a mikrovegetáció tömegprodukciós kialakulására (Untersuchung von Wasseraufbruch- [„Quellenhaltigen"] Bodenflächen in den natronhaltigen Gebieten der Süd lichen Grossen Tiefebene Ungarns mit besonderer Berücksichtigung der Entwicklung von Mikrovegetations-Massenproduktionen). — Szegedi Tanárk. Főisk. Tud. Közlem. *2,* 3—38.

KISS, I. (1970a): Újabb adatok a Kardoskút-pusztaközponti Fehér-tó algavegetációjához (Neuere Beiträge zur Algenvegetation des Fehér-tó bei Kardoskút-Pusztaközpont). — Szegedi Tanárk. Főisk. Tud. Közlem. *2,* 9—43.

KISS, I. (1970b): Egy bugaci szikes tó vegetációs színeződést előidéző algatömeg-produkciójáról (Über die eine Vegetationsfärbung hervorrufende Algen-Massenproduktion in einem bugazer Natrongewässer). — Szegedi Tanárk. Főisk. Tud. Közlem. *2,* 45—53.

KISS, I. (1970c): A Kakasszéki szikes tó mikrovegetációja (Die Mikrovegetation des Natronsees bei Kakasszék). — Szegedi Tanárk. Főisk. Tud. Közlem. *2,* 55—94.

KISS, I. (1972): A vízfeltörések szélsőségesen módosult algatömegprodukciós formái a Békés—Csanádi löszhát szikes területein (Extrem modofizierte Algenmassenproduktionsformen der Wasseraufbrüche in den natronhaltigen Gebieten des Békés—Csanáder Lösz-Rückens). — Szegedi Tanárk. Főisk. Tud. Közlem. *2,* 3—32.

KISS, I. (1973): Inäquale Zellteilung und mehrzellige Pseudothallus-Bildung in der Gattungen *Euglena, Phacus, Trachelomonas.* — III. Ungarische Pflanzenanatomisches Symposium 58—59.

KISS, I. (1974): Három Bugac-környéki szikes tó mikroflórájának és mikrovegetációjának összehasonlító vizsgálata (Vergleichende Untersuchung der Mikroflora und Mikrovegeration dreier Natronseen in der Umgebung von Bugac). — Szegedi Tanárk. Főisk. Tud. Közlem. *2,* 3—38.

KISS, I. (1975): A Fülöpháza-környéki szikes tavak mikroflórájának és mikrovegetációjának összehasonlító vizsgálata (Vergleichende Untersuchung der Mikroflora und Mikrovegetation der Natrongewässer bei Fülöpháza). — Juhász Gy. Tanárk. Főisk. Tud. Közlem. *2,* 3—35.

KISS, I. (1976): Magyarország szikes tavaiban végzett hidrológiai és algológiai vizsgálataim áttekintése (Der Durchblick meiner hidrologischen und algologischen Untersuchungen, die in den alkalischen Teichen von Ungarn gemacht wurden). — Juhász Gy. Tanárk. Főisk. Tud. Közlem. *2,* 51—69.

KISS, I. (1977a): Investigation of the water blooms of *Eudorina elegans* in the dead-arm of the river Tisza at the community Mártély. — Tiscia (Szeged) *12,* 37—47.

KISS, I. (1977b): Variability of Scenedesmus ecornis (Ralfs) Chod. in the dead-arm of the river Tisza at Körtvélyes. — Tiscia (Szeged) *12*, 49—57.
PÉTERFI, I. (1977): Az algák biológiája és gyakorlati jelentősége (The biology and practical importance of algae). — Bukarest.
UHERKOVICH, G. (1956): Alaki megváltozások mesterségesen befolyásolt tenyészkörülmények között nevelődő Scenedesmusokon (Veränderungen an Scenedesmeen in Kulturversuchen).— Pécsi Ped. Főisk. Évk. 1—9.
UHERKOVICH, G. (1959): Adatok a Tisza holtágainak mikrovegetációjához. A szolnoki Tisza holt ágainak algái 1957 őszén (Beiträge zur Kenntnis der Algenvegetation der Tisza- (Theiss) Altwässer I. Die Algen der szolnoker „Toten Tiszaarmes" im Herbst 1957). — Bot. Közlem. *40*, 30—40.
UHERKOVICH, G. (1961a): Tiszai algák a szaprobionta rendszerben (Algen of the Tisza river in the saprobionte System). — Hidr. Közlem. *41*, 85—88.
UHERKOVICH, G. (1961b): Das Leben der Tisza XIV. Ergänzende Beiträge zur Kenntnis der Algenvegetation des Szolnoker Tisza-Altwassers. Acta Biol. (Szeged) *7*, 89—94.
UHERKOVICH, G. (1963): Adatok a Tisza holt ágainak mikrovegetációjához II. A szolnoki Holt-Tisza fitoplanktonjának mennyiségi viszonyai (Daten zur Mikrovegetation der Tisza Altwässer II. Quantitative Verhältnisse des Phytoplanktons der Szolnoker Toten Tisza). — Bot. Közlem. *50*, 117—124.
UHERKOVICH, G. (1965): Aneurin hatása Scenedesmus tenyészetekre (Scenedesmus cultures as effected by aneurin). — Biol. Közlem. *13*, 59—64.
UHERKOVICH, G. (1967a): Neue und seltene Algen aus der Theiss (Tisza) und zwei Altwässern der Theiss. — Tiscia (Szeged) *3*, 3—11.
UHERKOVICH, G. (1967b): Über das Sommerplankton des Altwassers von Mártély. — Tiscia (Szeged) *3*, 13—20.
UHERKOVICH, G. (1971): A Tisza lebegő parány növényei. A Tisza fitoszesztonja (Die Mikrophyten in der Trift des Flusses Theiss (Tisza). Das Phytoseston der Theiss). — Damjanich J. Múz. (Szolnok) *20—22*, 1—282.
VÄLIKANGAS, I. (1922): Eine von *Euglena viridis* Ehrenb. hervorgerufene Vegetationsfärbung des Eises im Hafengebiet von Helsingfors. — Översikt av Finska Vetenskaps-Soc. Förhandlingar *64*, 1—22.

A Tisza körtvélyesi és mártélyi holt ágainak algarendszere és szezonális algatársulásai

I. KISS

Tiszakutató Munkacsoport, Szeged, Magyarország

Kivonat

A Tisza folyó Mártély község és Körtvélyes melletti holtágainak algaflóráját több ciklusban tanulmányoztuk. Mindkettőnek vize eutrofizálódott; különösen a mártélyi holt ágé. Az 1. sz. táblázatban jól látható, hogy a körtvélyesi holt ágban 1981-től viszonylag sok Euglenophyta species szerepel, amelyek az ide jutó szennyvízben trágyaanyagok jelenlétére mutatnak. Részletesen vizsgáltuk az algatársulások változásait, amelyek ugyancsak alátámasztják azt a tényt, hogy az algák nemcsak ásványi sókat, hanem a bomló szervesanyagokból aminosavakat szénhidrátokat, vitaminokat és növényi hormonokat is képesek felvenni. Ezt az algák indikátor értékének megállapításánál figyelembe kell venni.

A saprobitás és trophitás nemcsak azáltal függenek össze, hogy a saprobitást előidéző szerves anyagok mineralizálódva a trophitás fokát növelik, hanem úgy is, hogy e szerves anyagok némelyikét az algák közvetlenül inkorporálni képesek. Ez a részleges heterophia speciesen belül is eltérő lehet, azaz bizonyos szelektivitás is mutatkozik. Mindezek figyelembevételével az indikátor szervezetek értékelése s ezen át a biológiai vízminősítés reálisabb lehet.

Sistem i sezonske zajednice algi u mrtvajama reke Tise Körtvélyes i Mártély

KISS I.

Radna grupa za istraživanje reke Tise, Szeged, Hungaria

Abstrakt

Istraživanja algi u mrtvajama reke Tise kod naselja Mártély i Körtvélyes vršili smo u više navrata. Došlo je do eutrofizacije oba basena, naročito u mrtvaji Mártély. U mrtvaji Körtvélyes od 1981. godine uočljivo je relativno učešće velikog broja Euglenophyta species, koji ukazuju na prisustvo djubriva u prispelim otpadnim vodama (Tabl. 1). Utvrdjene promene zajednice algi takodje potvrdjuju činjenicu da su alge u stanju da pored mineralnih soli korite i aminokiseline, ugljene hidrate, vitamine i biljne hormone u toku procesa raspadanja organskih materija. Ovu činjenicu treba imati u vidu pri utvrdjivanju indikatorne vrednoati algi.

Uzajamna uslovljenost saprofitosti i trofičnosti ne javlja se samo usled mineralizacije organskih materija, već i putem direktne inkorporacije nekih organskih materija od strane algi. Ova delimična heterotrofija i intraspecijski može biti različita. Na osnovu ovih zapažanja, kako vrednovanje indikatornih organizama, tako i biološka ocena kvaliteta voda dobija u realnosti.

ВОДОРОСЛИ И ИХ СЕЗОННЫЕ СООБЩЕСТВА В СТАРИЦАХ ТИСЫ КЁРТВЕЙЕШ И МАРТЕЙ

И. Кишш

Рабочая группа изучения Тисы, Сегед, Венгрия

Резюме

Водоросли реки Тисы в нескольких циклах были изучены в старицах рек возле населенных пунктов Мартей и Кёртвейеш. Обе воды в этих старицах эутрофные, особенно в старице Мартей. В таблице 1% I хорошо видно, что в старице Кёртвейеш с 1981 года большую роль сыграли евгленовые, что показывает на то, что в этих местах сточные воды несут в себе смытые удобрения. Ознакомивши в детале со сменами водорослевых ценозов, пришли к заключению, что водоросли способны усвоить не только минеральные соли, но и вещества из распавших органических материалов — аминокислот, углегидратов, витаминов и раститель ных гормонов. Всех это следует учесть при определении оценки водорослевых индикаторов.

Сапрофитизм и трофитизм зависимы от друга не только точому, что сапрофитизм проявляющие органы, вещества минерализацией увеличивают степснь трофитизма, но и потому, что некоторые водоросли органические вещества сособны непосредственно инкорпофировать. Эта частичная специальная гетеротрафия может иметь и внутренные расхождения и тем самым производят определенную селекцию.

Учитывая все эти явления, оценка структуры индикатора и через них биологическая оценка воды может быть более реальной.

Tiscia (Szeged) Vol. XVII, pp. 67—88 (1982

BIOLOGICAL WATER QUALITY IN THE MÁRTÉLY AND KÖRTVÉLYES BACKWATERS OF THE TISZA FROM 1976 TO 1980, WITH SPECIAL REGARD TO PHYTOPLANKTON CHANGES

ENIKŐ DOBLER and KATALIN KOVÁCS

ATIVIZIG Szeged
(Received September 30, 1981)

Abstract

Authors report on the biological water quality of Mártély and Körtvélyes backwaters on the basis of investigations performed from 1976 to 1980. The seasonal changes of phytoplankton composition and the effect of flooding of the Tisza river on the phytoplankton of backwaters are discussed in detail. In high-water periods high-velocity river water of great suspended matter content flushes out the channels of the backwaters in the flood-plain. In these periods the phytoseston of the river determines the algal communities in the backwaters. The slowing down of the flow rate of the flooding water and the sedimentation of suspended materials takes place first in the backwaters. These processes, as well as the decomposition of the inundated flood-plain vegetation (organic matter content) create the favourable conditions for the phytoplankton characteristic of the backwaters and the season to develop. With the receding of water, this algal assemblage will be the core of the phytoplankton communities characterizing the backwaters.

Introduction

In our rivers and standing waters, the quantity and quality of phytoplankton exhibits seasonal variations. Uherkovich gives a detailed account of the seasonal changes of phytoseston composition of the Tisza in his work entitled "Phytoplankton of the Tisza" (UHERKOVICH 1971). Seasonal changes of phytoseston were observed also in the lower sections of the Tisza and Danube during studies performed there regularly (DOBLER and SCHMIDT 1980). Concerning the phytoseston composition of our larger rivers, the dominance of diatoms caused by special conditions of turbulence and high suspended matter content was observed except in the low-water period in late summer (BARTALIS 1978, UHERKOVICH 1966, 1968, 1969, 1971, 1972, 1975). Phytoseston composition characteristic of a particular stream, section of stream and season is essentially influenced, changed by the passing flood-waves. In periods of high river stage, the flow rate of the river increases as well as the quantity and size of suspended mineral particles. These latter mechanically affect the phytoseston organisms of the river, resp. unfavourably influence the light climate of the river by decreasing the transparence of water. In addition to the considerable diminution of total algal count, the changes of phytoplankton composition and the transformation to rheon type of the phytoplankton alre also indicative of the passing flood-wave (UHERKOVICH 1971). The backwaters of the Tisza are stagnant waters which self-individualized limnologically, and of which the seasonal changes of phytoplankton composition and quality are also characteristic. The Mártély and Körtvélyes backwaters are located in the flood-plain of the Tisza. Owing to their special connection with the river, these backwaters are flooded even by smaller flood-waves of the Tisza. They can get into temporary connection with the chemical and hydrological conditions of the river more than once in a year. The rushing in river water considerably affects the particular and rich microvegetation of backwaters. As evidenced by examinations performed in the backwaters of Atka and Serházzug never getting connected with the Tisza, the percentual ratio of diatoms in the phytoplankton of the backwaters generally characterizable with high ind./lit values is little except in late winter and early spring (DOBLER and HEGEDÜS: paper presented at the Tisza Research Meeting). During flooding a great mass of water of faster movement, loaded with suspended matter rushes also into the channels of backwaters and produce the aforementioned unfavourable effects on the phytoplankton organisms. The influence of flooding can be well illustrated not only by the diminution of total algal count, but also with the perishing of the phytoplankton community characteristic of the particular backwater and season, resp. the appearance of the special diatom dominance of the river (HORTOBÁGYI 1960, UHERKOVICH 1967, 1971). Subsequent to flooding, the rapid increase in the percentual ratio of diatoms was secured also by rheon type organisms *(Ceratoneis arcus, Diatoma anceps, Diatoma vulgare)* besides *Stephanodiscus* spp. *resistant* to the damaging effects of suspended materials. Species with more fragile silicified skeletons soon appear *(Nitzschia acicularis, Melosira gran.* var. *angustissima)*. After the passing of the flood-wave, phytoplankton density increases and the phytoplankton characteristic of standing waters develops. Later with the decreased share of diatoms in phytoplankton, the dominance of the species belonging to Chlorococcales increases parallel with the increasing in individual numbers of other algal groups. By then the phytoplankton composition of the backwaters is entirelly different from the phytoseston composition of the river. With the decreasing of the river stage, namely, the backwaters loose their connection with the "living water" and start to live their own life (UHERKOVICH 1971).

The papers published in this topic by HORTOBÁGYI and KISS have given us great assistance in these phytoplankton analyses (KISS 1977a, b, 1978a, b, 1979a, b, HORTOBÁGYI 1939a, b, 1941). The seasonal changes of phytoplankton in the Mártély and Körtvélyes backwaters resp. the effect produced by the flooding of the Tisza on the phytoplankton communities of these backwaters will be discussed later in detail.

Materials and Methods

Since the middle of the seventieth a method not used before by us was adopted in our hydrobiological examinations. This new procedure was probed in the stagnant waters located in the grounds of ATIVIZIG, and in this way it could be arranged in agreement with the Board of Tisza Research to perform regular investigations in the backwaters of the nature conservation areas from 1976.

Brief description of method:

1. It was accepted as a basic rule to take the samples necessary for chemical and bacteriological analysis parallel with the samplings for biological examinations. This means that the allocated area of water was studied in a complex way.

2. In the course of the biological examinations the halobity, trophity, saprobity and toxicity of the particular waterarea was determined. Water samples were generally collected monthly for 5 years (Tables 1, 2) in the following places:

1. Mártély backwater: strand of Mártély; open water; at 20 cm below water surface.

2. Körtvélyes backwater: watch-house at Körtvélyes dam; open water; at 20 cm below water surface.

Examinations performed and methods applied:

1. Measurement of conductivity (Measurement of the specific electric conductivity of water).
2. Determination of the total number of algae (Counting on membrane filter)
3. Determination of chlorophyll a content (Chlorophyll determination)
4. Counting of Pantle-Buck saprobity index (Pantle-Buck saprobiological analysis).

The examinations were performed according to the methods described by FELFÖLDY in his book entitled "Biological water qualification" (third revised and enlarged edition) (1980) under the chapters given above in parenthesis. The results are summarized in Tables 1 and 2.

Phytoplankton communities of lakes and rivers can be analyzed both quantitatively and qualitatively (FELFÖLDY 1980). In both cases the analysis is based on countings on dipped samples. Our further investigations in both backwaters were performed according to the above criteria (HORTOBÁGYI 1962).

For obtaining a better survey of results we used Maucha's star-diagram adapted to algological studies by Hortobágyi (HORTOBÁGYI 1957, 1963). The essence of this method is the following: Similarly to the 8 cations present in greater amounts in our natural waters, the algae of our waters can also be ranged into 8 sectors. Starting from north and proceeding in clockwise direction, the single sectors represent the following groups of algae:

phylum Cyanophyta
phylum Euglenophyta
class Xanthophyceae
class Chrysophyceae
class Bacillariophyceae (diatoms)
class Chlorophyceae
class Conjugatophyceae = Zygophyceae

The star-diagrams illustrating phytoplankton composition in the Mártély and Körtvélyes backwaters are presented among the figures. Time of sampling is indicated with the total algal count (ind./lit), and chlorophyll a concentration is illustrated with histograms.

Pictures deserving special attention from the point of view of high water level were marked with +.

Results

Our results in connection with biological water quality determined by the aforementioned methods were grouped according to the following 4 concepts:

(a) halobity
(b) trophity
(c) saprobity
(d) toxicity

(A) Mártély backwater

(a) The inorganic ion content of the backwater was measured by specific electric conductivity. On the basis of average values this backwater proved to be beta-alpha-oligohalobic, freshwater of medium quality. This condition did not change in the period of examination, which means that the backwater was not polluted, at the same time, however, due to changes of river stage the bed of the backwater was flushed trough each year once, in rainy years even three times (see: the technical description of backwaters), meaning that the ionic environment of the Tisza prevailed for shorter or longer periods. Only in late summer and early autumn vegetation periods developed a higher salt concentration here, which characterized the backwater until the next high water level.

(b) To establish the planktonic trophity of the backwater we determined the chlorophyll a concentration and the number of algae in one liter water. On the basis

Table 1. *Results of the biological examinations in Mártély backwater 1976—1980*

Year	Number of samples	Conductivity $10^{-6}\ \Omega^{-1}cm^{-1}$	Total algal count ind./lit $\times 10^6$	Chlorophyll a mg/m³	P—B S index
1976	9	min: 230 max: 590 av: 461	min: 2.34 max: 20.73 av: 10.73	min: 2.2 max: 29.4 av: 12.7	min: 1.87 max: 2.22 av: 2.05
1977	12	min: 325 max: 780 av: 480	min: 1.33 max: 35.72 av: 15.18	min: 1.4 max: 71.9 av: 24.5	min: 2.00 max: 2.42 av: 2.17
1978	12	min: 300 max: 540 av: 417	min: 6.99 max: 115.55 av: 21.34	min: 2.2 max: 53.4 av: 20.3	min: 1.83 max: 2.28 av: 2.10
1979	10	min: 335 max: 505 av: 419	min: 4.22 max: 41.52 av: 22.64	min: 2.2 max: 51.0 av: 23.2	min: 1.81 max: 2.43 av: 2.06
1980	8	min: 369 max: 578 av: 455	min: 5.10 max: 39.36 av: 17.66	min: 7.3 max: 198.7 av: 37.6	min: 1.94 max: 2.41 av: 2.08

of the average values of these components the water body proved to be mesoeutrophic resp. eupolytrophic: rich in nutrients, highly productive.

Of the results presented in Table I, the data on trophity are listed in columns 2 and 3. A peak value (198.7 mg/m³) among the chlorophyll a concentrations occurred only in 1980, which was accompanied by a medium algal count. In 1978, to an algal count of 115.55×10^6 only a medium pigment concentration belonged. Both results will appear reasonable if we consider the dominating algal strains in the evaluation.

In the first case the high chlorophyll a concentration was due to Cryptomonas spp. (20—50 μ) belonging to phylum Pyrrophyta and (in 1978) the great algal count to the presence of algae of 5—10 μ belonging to Chlorophyta (Fig. 5). It is easy to understand that for the outstanding results the differences in size of the organisms studied were responsible.

(c) The degree of pollution in the backwater was characterized by the average computed by means of the Pantle-Buck saprobity index. On this basis the water body was little polluted and the average values of the S index were not in excess of 2.30 in the period of investigation. By way of explanation it should be noted that the backwater was not loaded with so much organic pollutants that the natural bacterium flora could not decompose in a short time. We believe that the frequent flushing out of the channel also contributed to this favourable condition since in this way the surplus in organic materials (nutrients) originating from the decomposition of organic materials produced in the backwater could not accumulate, though they do in the sediment in every other case. The sediment of the channel — as it could also be established by visual examination — was healthy, and contained only little sapropel.

(d) During the examination period the backwater was not toxic. Charaterization of the backwater on the basis of phytoplankton composition.

In the water samples taken at the end of March 1976 values for algal contenct were average, exhibiting the dominance of euglenophytes. A picture similar to that was found in that year during September, October and November, and in the latter cases that water body was characterized also by the presence of green algae belonging to Chlorophyta, besides the aforementioned phylum. In April, June and July, Pyrrophyta also appeared in greater numbers in the phytoplankton. The elements which originated from the slow decomposition of nutrients in winter were rapidly utilized by the phytoplankton vegetation in spring when the temperature increased and the quantity of light became more favourable.

Species appearing with the decreasing nutrient level are rare (FELFÖLDY 1981), though it is known of Dinobryon divergens (Chrysophyceae) that it can well utilize phosphates of very low concentration. In the water samples taken on April 30, 1976, the species mentioned in the foregoing occurred in greater individual number, and the total dissolved phosphorus content of water was 0.07 mg/lit. In November, this group was represented by Chrysococcus biporus. In this year water level increased two times above the height of the summer dam, i.e. in April and December (Fig. 1).

In both cases, the great percentual ratio of diatoms (34—36%) was evident beside a small total algal count and low chlorophyll a concentration. In months without flood this value did not exceed 5—6%. During the flood in April,the dominance of Nitzschia acicularis, and during the flooding of December the dominance of Stephanodiscus hantzschii were characteristic. Ceratoneis arcus and Diatoma anceps spp. which are rheon type organisms of the river in winter occurred in great numbers.

In 1977, despite the high water level we could collect the water samples necessary for the analyses in each month. Thus, we were able to follow the seasonal changes, too. In March, April the picture was characteristic of the period of flooding, moreover, the influence of the high water level could be observed even during May and June.

From February to June, the dominance of diatoms was evident *(Nitzschia subtilis, Stephanodiscus hantzschii, Stephanodiscus dubius, Stephanodiscus astrea)*. The

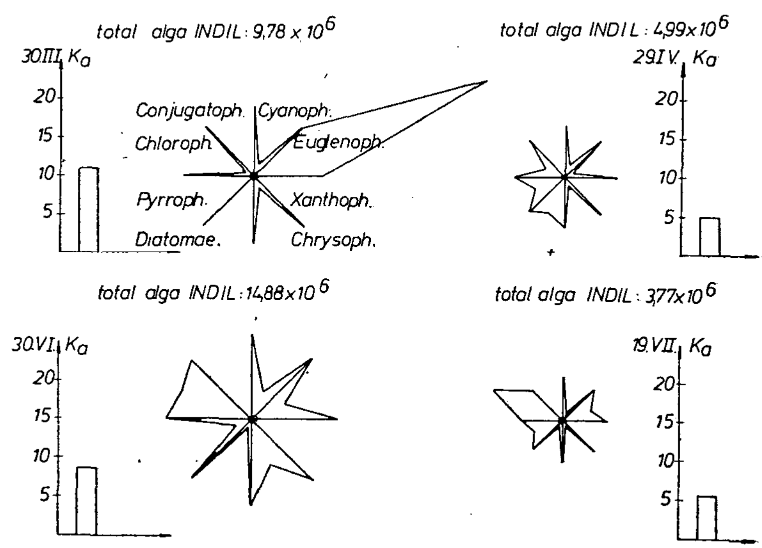


Fig. 1/a

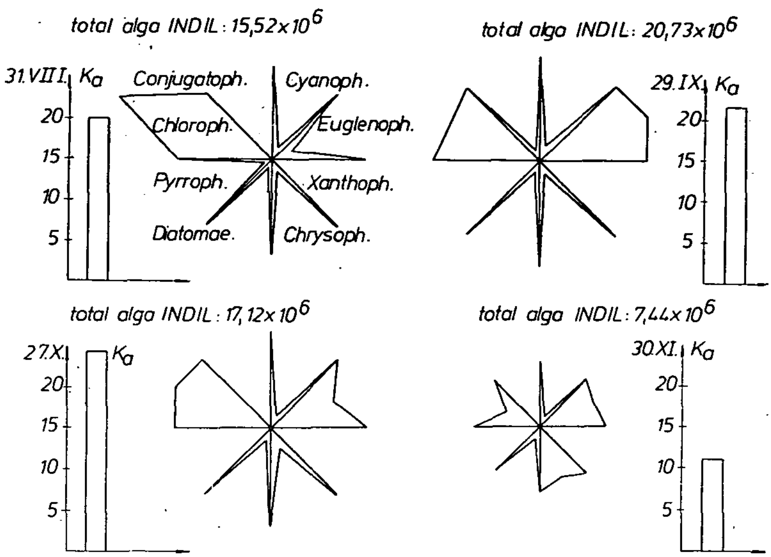


Fig. 1/b. Mártély backwater, 1976

37% ratio of diatoms found during the sampling period without flood in May had increased again to 70% in the stagnant water developed by the end of June. The effect of recurrent floodings could be observed for a long time, and the phytoplankton communities characteristic of the backwater could only develop by late summer.

During autumn, the backwater was characterized by a lastingly developed total algal content which showed a good correlation with chlorophyll a concentrations. Phytoplankton composition was characterized by the dominance of Chlorophyta.

Unusually great algal count was found also in December for which the ice conditions must have been responsible, namely the water was sampled from under

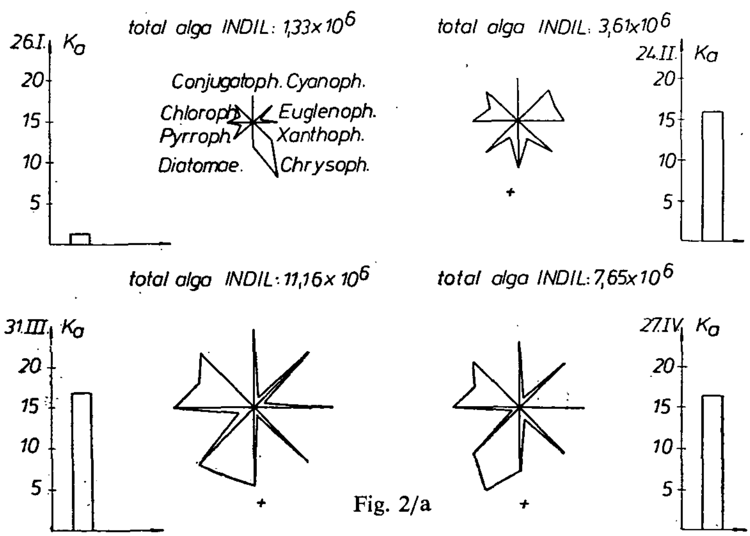


Fig. 2/a

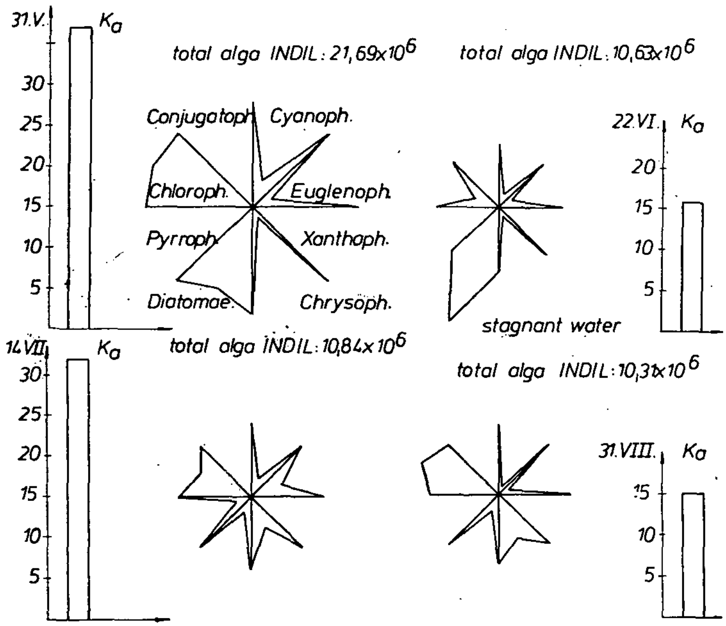
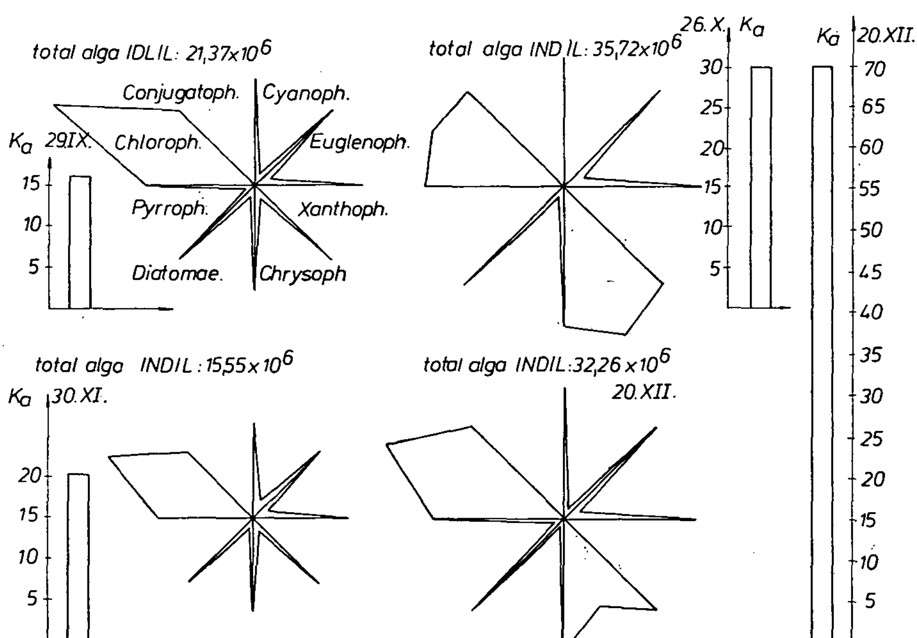


Fig. 2/b

an ice cover of 10 cm, but the snow-blanket did not inhibit at the same time the penetration of light into the water (Figs. 2, 3).



Figs. 2., 3. Mártély backwater, 1977.

In 1978 lastingly high water level occurred, and thus its effect on the phytoplankton composition of the backwaters could be measured in this year.

In periods of flooding, the lasting percentual ratio (25—40%) of diatoms was constituted by *Cyclotella glomerata, Cyclotella pseudostelligera, Nitzschia acicularis, Scelatonema subsalsum, Stephanodiscus hantzschii, S. astrea.* The species of *Cyclotella* had not characterized the backwater earlier.

In August, the effect of the passing of the flood-wave became evident, the numbers of the representats of the class Bacillariophyceae decreased, while the dominance of the phylum Euglenophyta and that of Chlorophyceae increased. At the same time, the algal count and the pigment content pertaining to it were extremely great. Concerning the values obtained it should be mentioned that such a value was not found elsewhere. This is likely to be due to the fact that temperature, illumination, length of day, water movement necessary for phytoplankton growth were optimal since otherwise the harmony of the aforesaid environmental factors could not have manifested themselves in this year during the whole vegetation period. Of the organisms inhabiting open water only Scherffelia deformis became competitive.

In October and November, the phytoplankton composition found in 1976 and thought to be characteristic of the backwater was restored. The water was again characterized by Chlorophyceae — Euglenophyta — Chrysophyceae plankton assemblages (Figs. 4, 5).

In 1979, for the lastingly high water level in spring, samplings were started only in May when the effect of the flood was still observable.

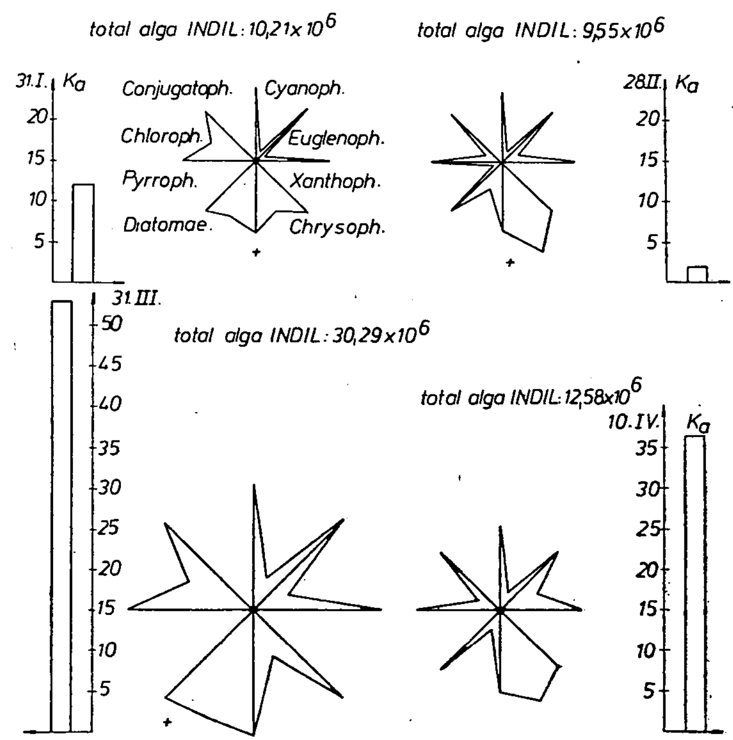


Fig. 4/a

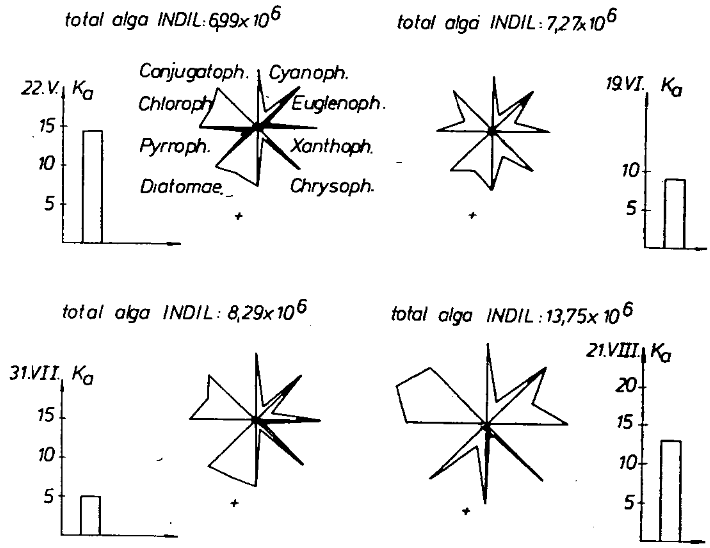

total alga INDIL: 6,99x10^6
total alga INDIL: 7,27x10^6
22.V. Ka
Conjugatoph.
Cyanoph.
Chloroph.
Euglenoph.
Pyrroph.
Xanthoph.
Diatomae.
Chrysoph.
19.VI. Ka
total alga INDIL: 8,29x10^6
total alga INDIL: 13,75x10^6
31.VII. Ka
21.VIII. Ka

Fig. 4/b

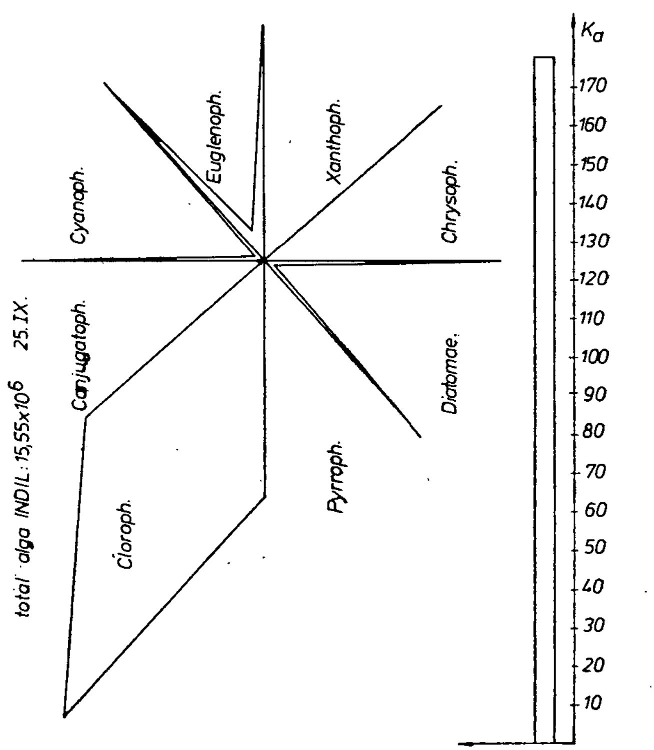
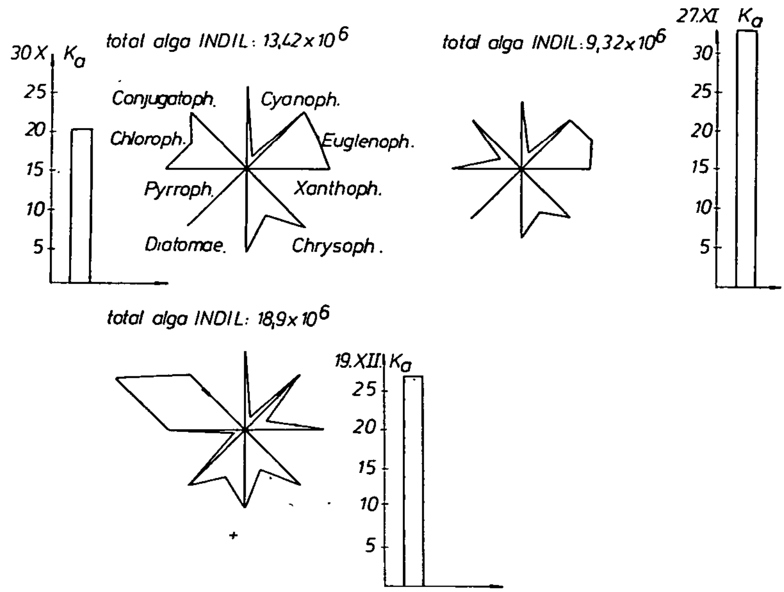

Ka
Euglenoph.
Xanthoph.
Cyanoph.
Chrysoph.
25.IX.
Conjugatoph.
Diatomae.
total alga INDIL: 15,55x10^6
Cloroph.
Pyrroph.

Fig. 5/a



Figs. 4., 5. Mártély backwater, 1978.

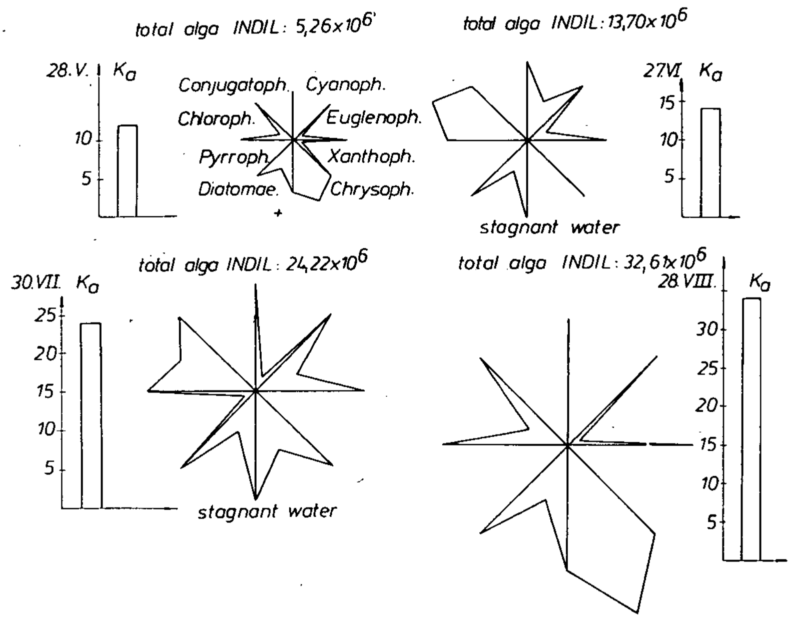
After the passing of the lasting spring flood, the ratio of diatoms decreased from 30%to 10%. *Stephanodiscus hantzschii* was the most characteristic species. In June, in the stagnant water formed after flooding, the diatom Attheya zachariasi was numerous. Its increase in number as in the case of *Nitzschia acicularis* must have started only after the cessation of the damaging mechanical effects. After flood time by the rapid slowing down of water movement and the bettering of light conditions in water, *Chrysococcus rufescens* and *C. biporus* characteristic of the backwater became very numerous, preponderating over the representants of the class Chlorophyceae. In September, the green algae became again typical, and they showed an even greater increase during October, and in November besides a sudden increase of Pyrrophyta, were still present in fairly great individual numbers. In December, species belonging to phylum Cyanophyta also took a considerable share in the composition of phytoplankton (Fig. 6, 7).

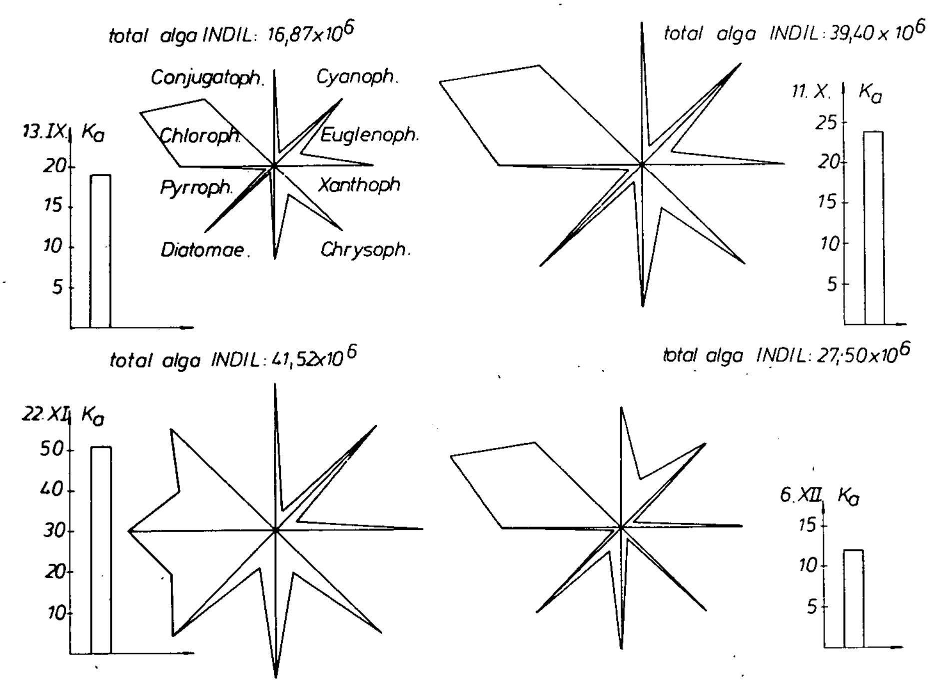
In January 1980 members of Cyanophyta also occurred, exhibiting a great green algal count. In January the samples were taken again from below the ice cover. This condition lasted till the end of March.

The ratio of diatoms in samples taken from under the ice cover without snow-blanket was 10%. *Melosira distans, Nitzschia acicularis* and *Stephanodiscus hantzschii* were present in great numbers. This value which is not connected with flooding is thought to be the consequence of the rapid increase of diatoms occurring usually in late winter and early spring.

For the water level which lasted from the end of June to the onset of autumn, the spring phytoplankton communities could not be replaced by the usual sommer ones.

During the period of flooding which lasted from May to early autumn, density

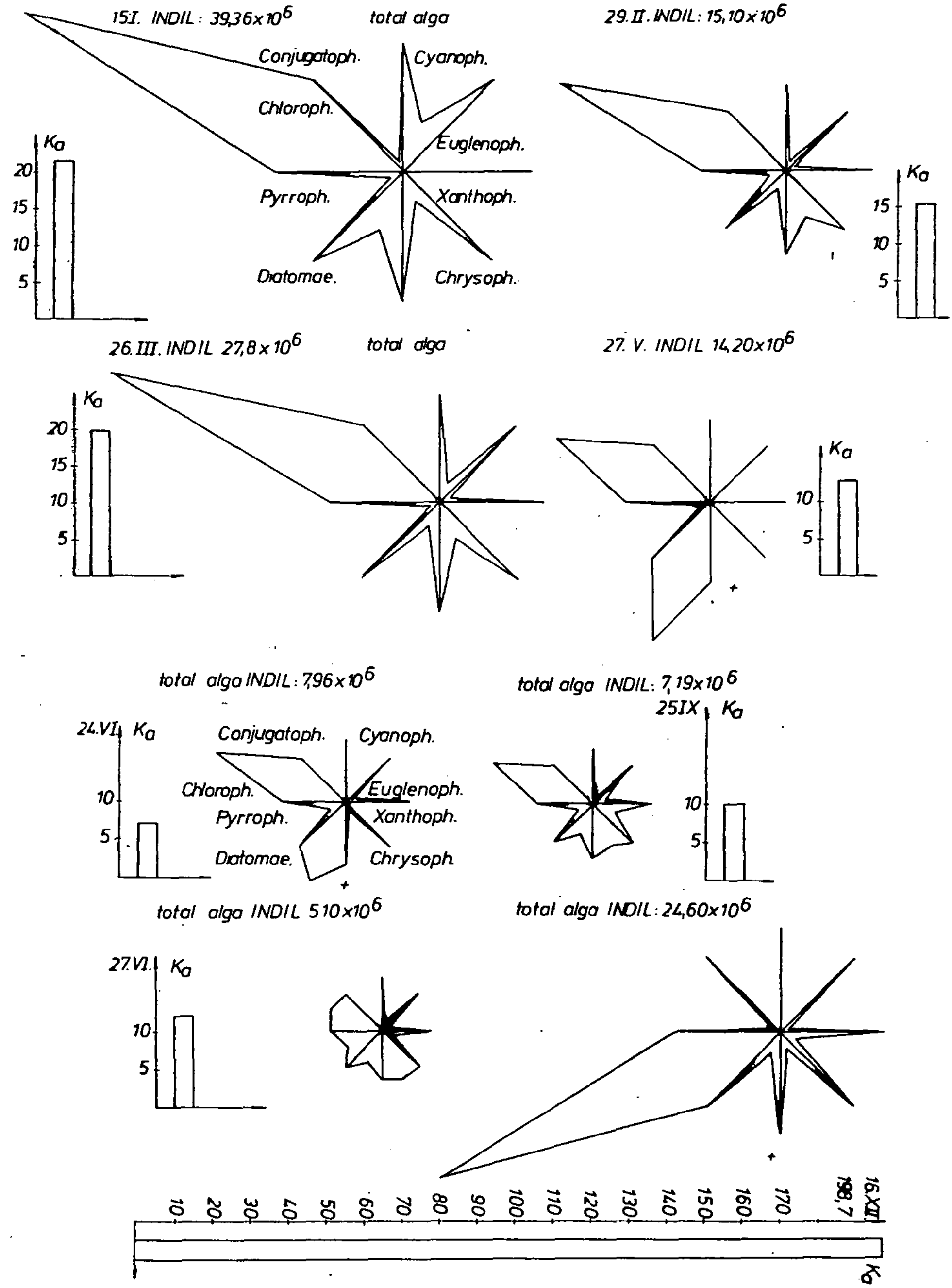




Figs. 6., 7. Mártely backwater, 1979.

and composition of phytoplankton showed a picture conform to our experiences (Figs. 8, 9).

In December, instead of the usual picture, the dominance of Pyrrophyta characterized the backwater (The water was covered with a thin layer of ice).



Figs. 8., 9. Mártély backwater, 1980.

(B) Körtvélyes backwater

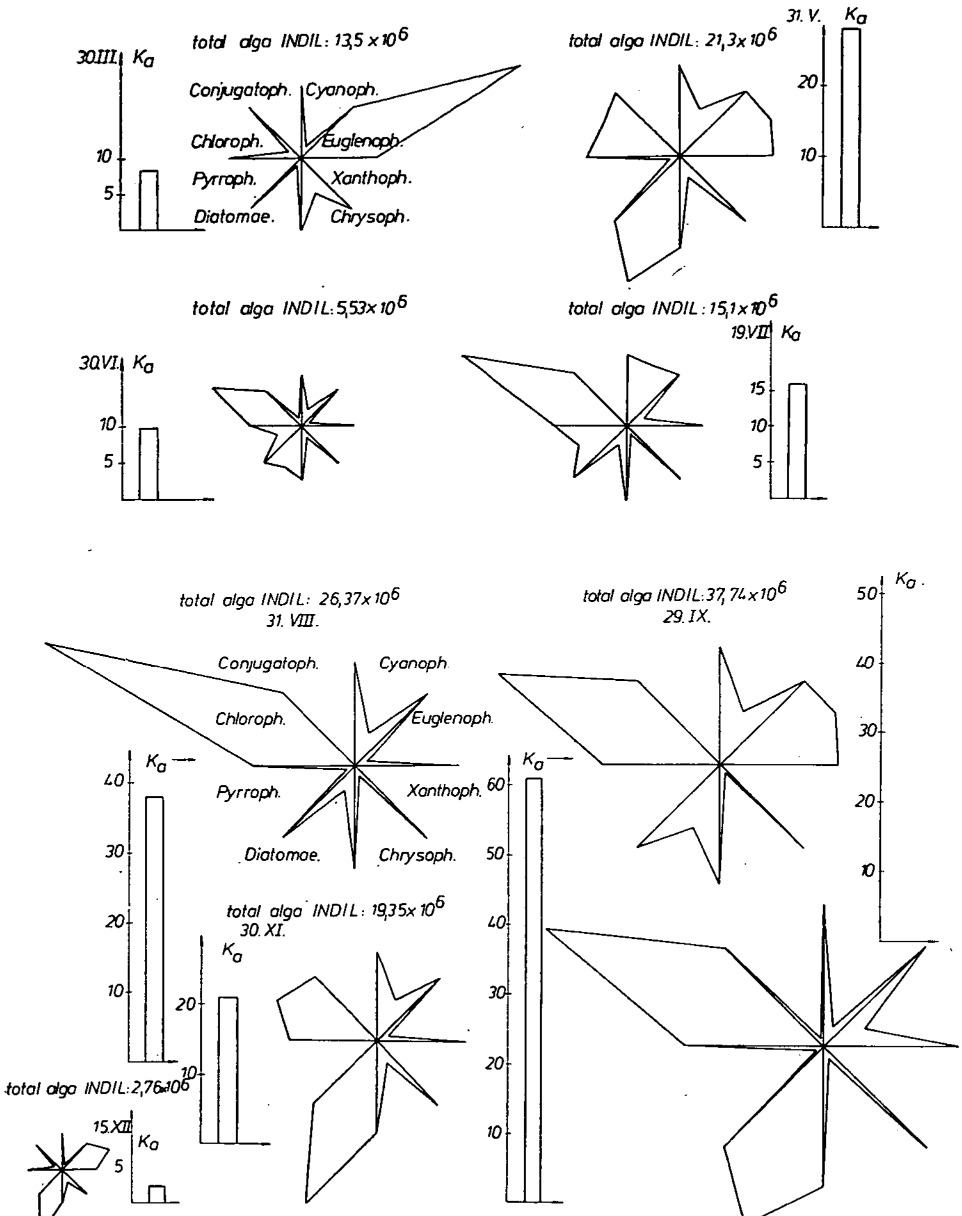
(a) The halobity of Körtvélyes backwater was also measured by specific electric conductivity. On the basis of average values, its water proved to be alpha-oligohalobic, pure freshwater in 1976, 1977, while in 1978, 1979, 1980 beta-alpha-oligohalobic, freshwater of medium quality. It is remarkable that at the beginning of the examination period the anion type of the water body was HCO_3—SO_4, later the SO_4— content diminished and CO_3—HCO_3 came to the prominence. This change was definitely favourable, since generally sulphate accumulation takes place in the sediments of standing waters along the Tisza river. This sulphate content is known to be transformed by reducing microbiological processes into sulphide in very eutrophic lakes, and the released H_sS endangers the biota of the water bodies (VÁMOS 1972).

It seems, that we should not yet be affraid of that. The decrease of sulphate content is obviously due also here to the lasting water level of the Tisza, which characterized the late seventies. Similarly to the Mártély backwater, this backwater is also located in the flood-plain, and thus the flushing out of both backwaters occurs practically in the same time.

(b) For the establishing of the planktonic trophity of the backwater, the chlorophyll a concentration of the water was measured and the algal content in one liter water was determined. On the basis of the average values of the components the backwater proved to be mesoeutrophic — except in 1977 — resp. eupolytrophic on the basis of the algal count; rich in nutrients and highly productive. In 1977 average chlorophyll a concentration was higher and therefore this backwater was qualified as eutrophic (Table II). Peak values were not obtained in this case either, differences of order not existing between the phytoplankton communities of the two backwaters.

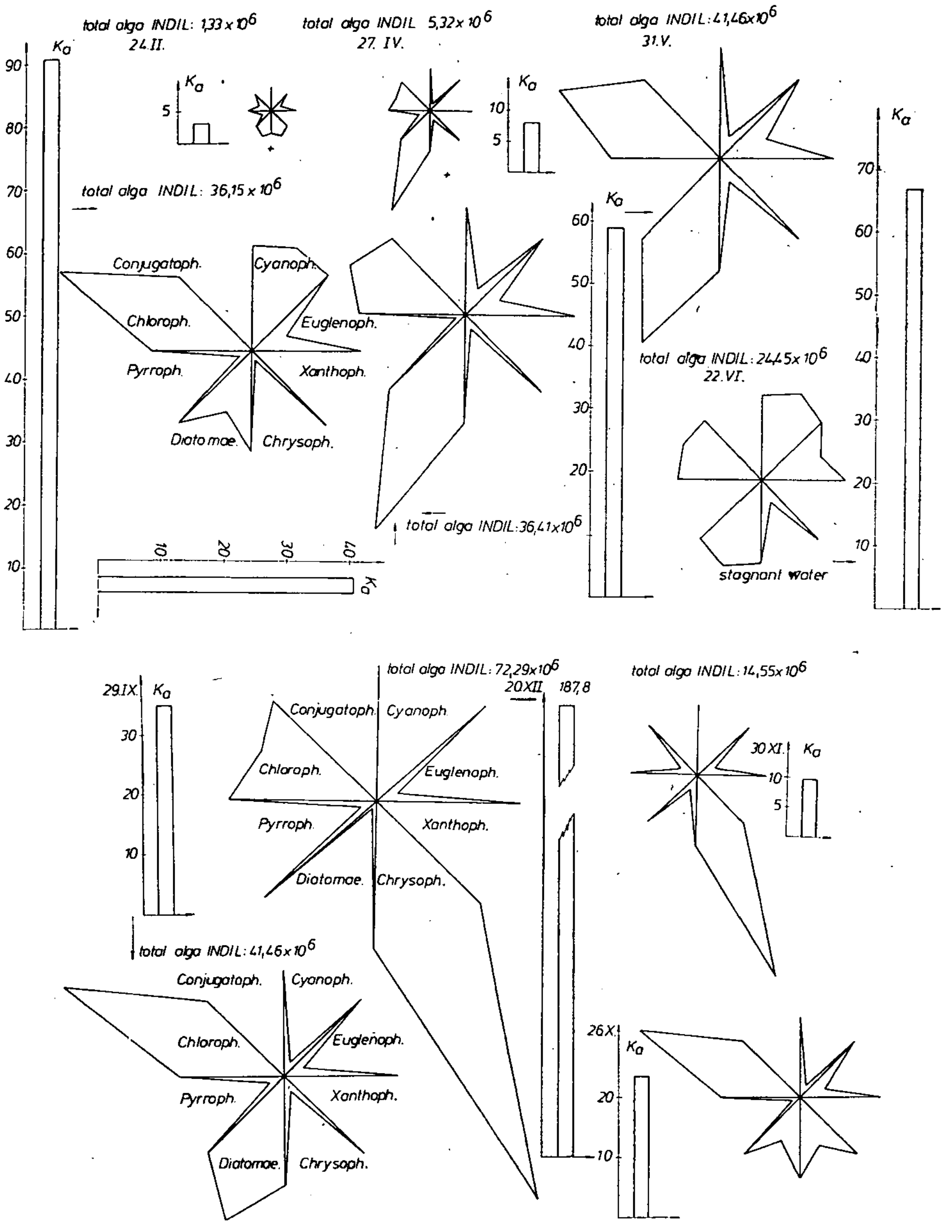
Table 2. *Results of the biological examinations in Körtvélyes backwater 1976—1980*

Year	Number of samples	Conductivity $10^{-6}\ \Omega^{-1}cm^{-1}$	Total algal count ind./lit $\times 10^6$	Chlorophyll a mg/m³	P—B S index
1976	9	min: 365 max: 802 av: 661	min: 5.528 max: 51.028 av: 21.40	min: 2.5 max: 61.5 av: 25.9	min: 1.86 max: 2.24 av: 2.07
1977	10	min: 330 max: 745 av: 570	min: 1.329 max: 72.289 av: 29.36	min: 3.3 max: 187.8 av: 52.59	m n: 1.75 max: 3.10 av: 2.27
1978	10	min: 320 max: 660 av: 529	min: 3.075 max: 68.04 av: 26.69	min: 3.5 max: 95.1 av: 43.13	min: 1.83 max: 2.42 av: 2.15
1979	9	min: 300 max: 780 av: 524	min: 9.36 max: 55.8 av: 23.93	min: 5.8 max: 45.9 av: 25.62	min: 1.94 max: 2.72 av: 2.27
1980	6	min: 240 max: 560 av: 413	min: 1.53 max: 48.4 av: 17.36	min: 7.2 max: 70.7 av: 29.73	min: 1.91 max: 2.22 av: 2.01



Figs. 10., 11. Körtvélyes backwater, 1976.

(c) The pollution of the Körtvélyes backwater was also characterized with the avearge computed on the basis of Pantle-Buck saprobity index. This water body was little polluted, and in the period of examination the average values for S index did not increase above 2.30. Organic load was not essential, and the water could be



Figs. 12., 13. Körtvélyes backwater, 1977.

characterized with saprobity in early spring and winter, trophity being the same in both backwaters during the vegetation periods. The period of flooding constituted an exception, since then the natural seasonal conditions were disturbed.

(d) During the investigation period the backwater was not toxic.

Characterization of the backwater on the basis of phytoplankton composition.

In 1976 greater (average) total algal count characterized the backwater, the dominant groups of phytoplankton being also different from those of the Mártély backwater. Besides the dominance of Chlorophyta, the phylum Canophyta also seemd to be important. However, the dominance of Euglenophyta was evident also in this water body in March, May resp. September, Oktober and December (Fig. 8). The star-diagrams of the Körtvélyes backwater clearly suggest that the late spring and autumn increase in species and individual numbers of diatoms was characteristic of the backwater independently from flooding. The approx. 30% share of diatoms in phytoplankton composition observed in May 1976 — *Melorina granulata* var. *angustissima, Stephanodiscus hantzschii* — decreased below 20% by late summer, then increased again gradually to 45—50% from September. In this year the backwater was flooded by the Tisza only in December, causing the abundance of individuals of rheon type *Diatoma vulgare, Diatoma anceps.*

In 1977, winter and early spring floodings characterized the Körtvélyes backwater. In these periods the spring increase of diatoms typical of backwaters and the effect of flood on diatom increase interlapped. *Nitzschia acicularis* characterizing the samples taken in February was gradually supplanted by *Stephanodiscus hantzschii* in April, May.

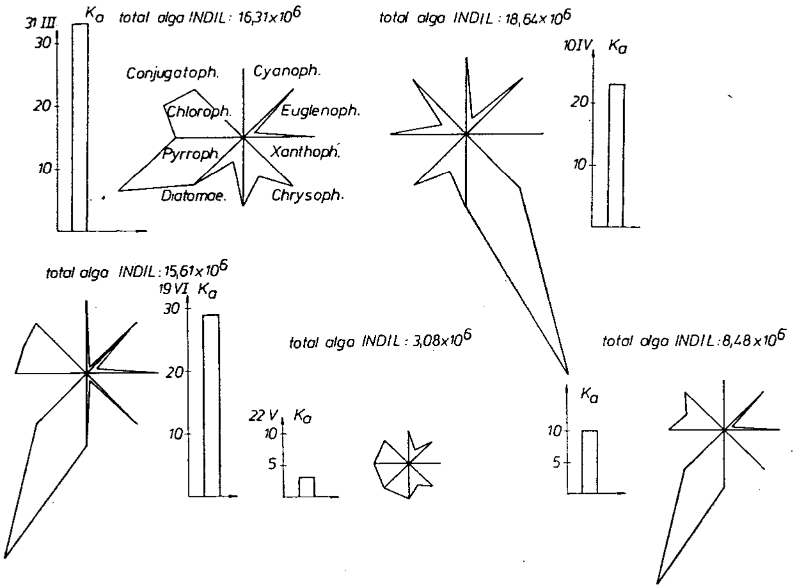
In May, June and July, 1977, following the spring high-water period, the Cyanophyta-Euglenophyta-Bacillariophyceae-Chlorophyceae association characterized the water. The characteristic increase of diatoms in the backwater in autumn was again evident in August, September and October. During this period diatoms and green algae prevailed, wherease in November and December the Chrysophyceae (Figs. 12, 13).

During the flood time in spring 1978, phytoplankton exhibited a great variability, members of different groups prevailing in nearly each month. In March Pyrrophyta, in April Chrysophyceae, in May 4 groups within a smaller algal count became dominant. In June, July diatoms characterized the water. In August, *Euglena* sp. characteristic of the spring period dominated. In September, for the prevalence of Scherffelia deformis and that of *Chlamydomonas simplex,* the majority of phytoplankton was made up of green algae. In autumn the diatoms were prevalent and in November, December the diatoms were supplanted again by Euglenophyta and Chrysophyceae (Figs. 14, 15, 16).

The ratio of diatoms increased to 60—70% when the flood-plain became lastingly inundated in spring and summer, the individuals of *Cyclotella glomerata, Nitzschia subtilis, Stephanodiscus dubius, S. hantzschii* being represented in greatest numbers. The increase of diatoms characterizable by the presence of *Cyclotella comta* and *Stephanodiscus hantzschii* shifted in this year to October, November. The plankton associations succeeded one another according to a most varied pattern in this year.

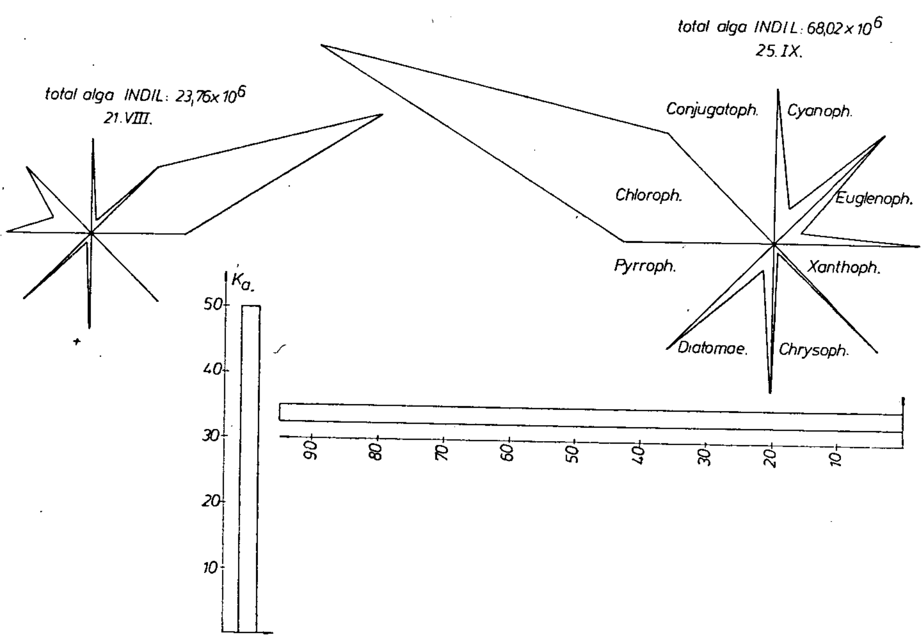
Species competition well known in ecology could be observed in 1979, as well. From January through April the Chrysophyceae alternated with the Bacillariophyceae. This became balanced by May, and both groups predominated in nearly identical individual numbers. In June the backwater was characterized by Chlorophyceae and Bacillariophyceae. In summer the plankton contained the organisms in equal proportion — excepting two or three groups — giving the impression of balanced conditions. In autumn, besides the species of chlorophyceae those of Cyanophyta increased again essentially, though the subdominance of Chrysophyta — Bacillariophyceae — Pyrrophyta could not be left out of consideration either (Figs. 17, 18).

In this year the greater (70%) percentual ratio of diatoms became evident already



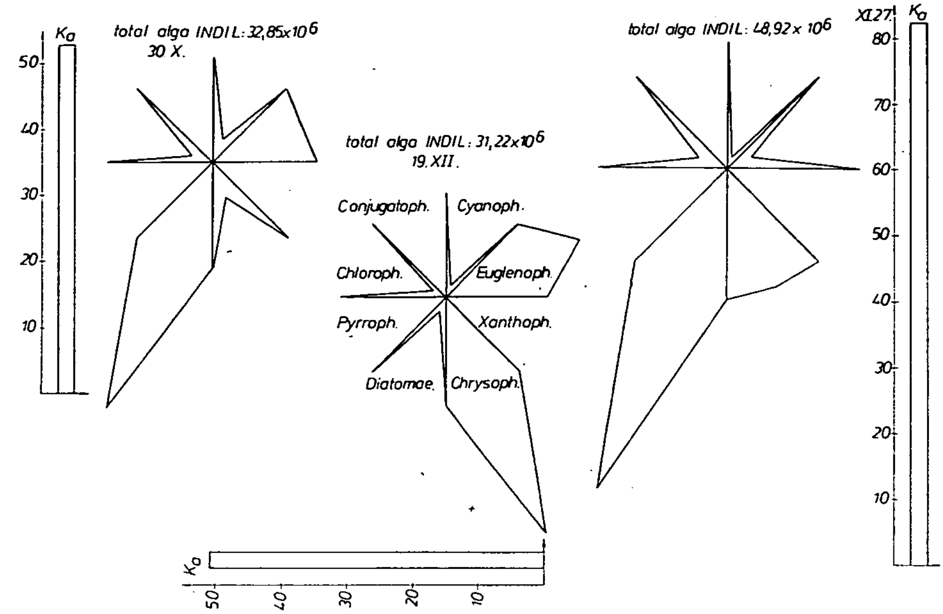
31 III
Ka
total alga INDIL: 16,31x10^6
Conjugatoph.
Cyanoph.
Chloroph.
Euglenoph.
Pyrroph.
Xanthoph.
Diatomae.
Chrysoph.
total alga INDIL: 18,64x10^6
10 IV
total alga INDIL: 15,61x10^6
19 VI
total alga INDIL: 3,08x10^6
22 V
total alga INDIL: 8,48x10^6

Fig. 14



total alga INDIL: 68,02x10^6
25. IX.
total alga INDIL: 23,76x10^6
21. VIII.
Conjugatoph.
Cyanoph.
Chloroph.
Euglenoph.
Pyrroph.
Xanthoph.
Diatomae.
Chrysoph.
Ka.

Fig. 15



Figs. 14., 15., 16. Körtvélyes backwater, 1978.

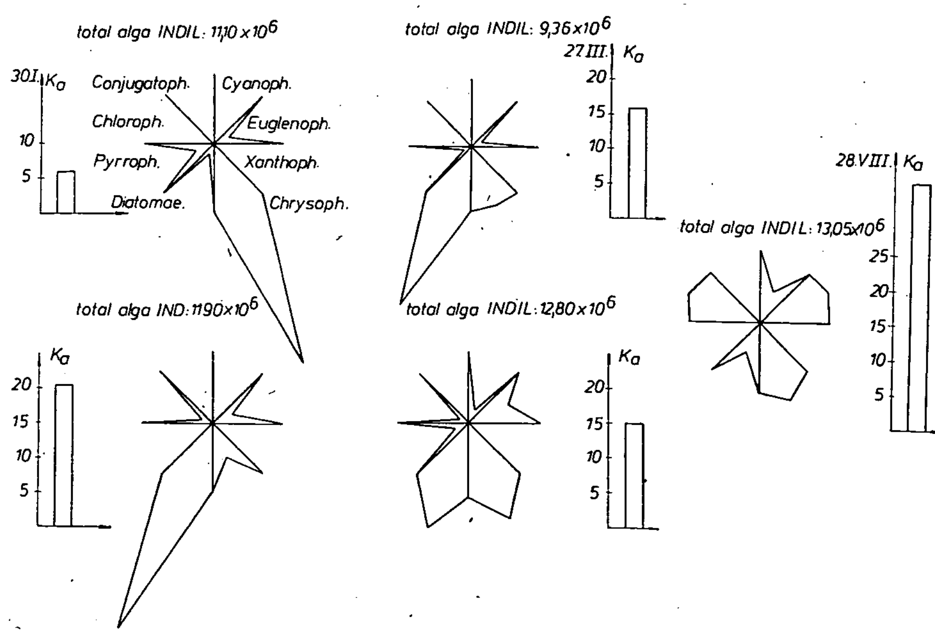
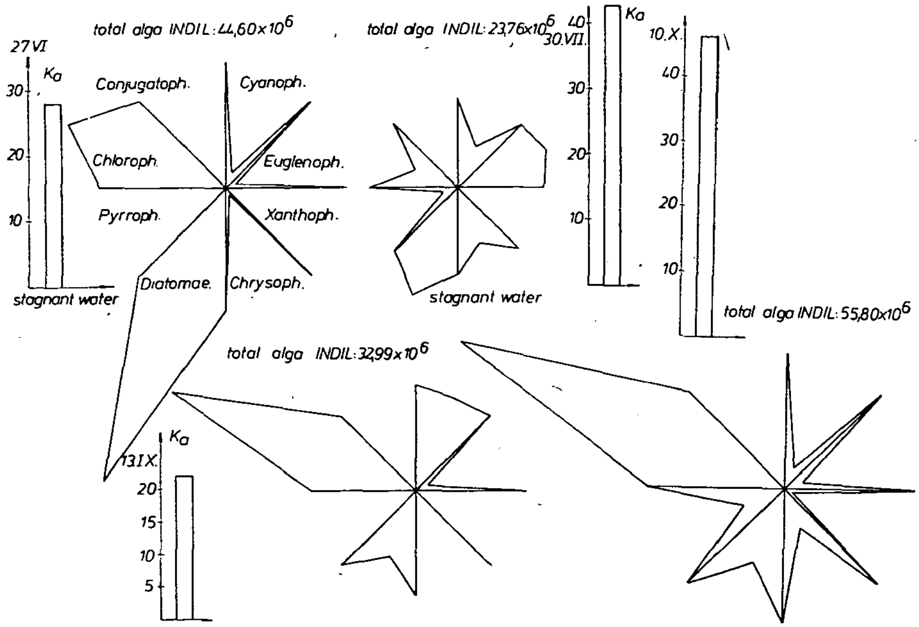


Fig. 17



Figs. 17., 18. Körtvélyes backwater, 1979.

in March. In April, this value increased to 80%, and because of the high-water period in May remained at this level by the end of July. The fragile species *Nitzschia acicularis* characteristic of the spring period was gradually replaced by *Cyclotella stelligera, Nitzschia longissima* var. *reverse, Stephanodiscus astrea, S. hantzschii.* The autumn maximum of diatoms observed earlier did not occur in this year.

In 1980, phytoplankton composition varied again according to the course of water. In January — in the samples taken from under the ice cover — the more frequent Xanthophyceae — Bacillariophyceae and Chlorophyceae community characterized the water, in February most interestingly only the total algal count diminished, the qualitative composition of the phytoplankton remained unaltered. In May, June, on the effect of the flooding in late spring diatoms preponderated, but the green algae were replaced by Pyrrophyta. In summer the Tisza was characterized by a long lasting water level in an unusual period, causing the flushing out effect of it — low algal concentration — to take place during September and October (Fig. 19).

The autumn maxima of diatoms observed earlier were not unequivocal.

* * *

1. The examinations necessary for the biological qualification of water proved to be sufficient for the qualification of both backwaters.

2. Concerning the qualitative and quantitative composition of phytoplankton, the Körtvélyes backwater exhibited a greater variability, the algal counts being generally greater, and the sudden increasing in species number occurring more frequently.

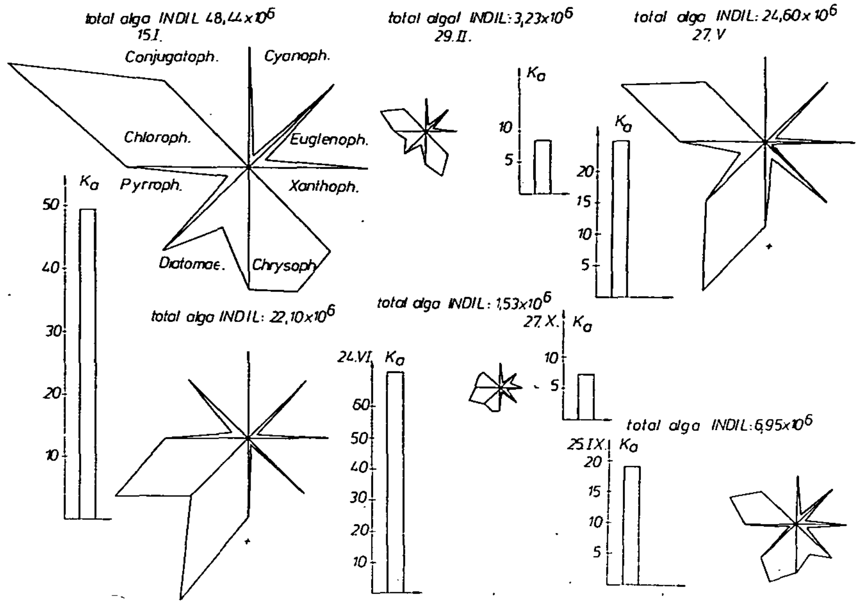


Fig. 19. Körtvélyes backwater, 1980.

3. The analysis of phytoplankton association was made by the determination of the algal counts. The phytoplankton communities characterizing both backwaters — high-water periods also included — were established.

References

CLEVER-EULER, A. (1951—1955): Die Ditomen von Schweden und Finnland I—V. Kongl. Svenska Vetenkaps-Akademien Hadlinger.

DOBLER, E.—SCHMIDT, A. (1980): Weitere vergleichende Beiträge zur Kenntnis limnologischer Verhältnisse der Donau und Theiss. — Tiscia (Szeged) *15*, 45—51.

FELFÖLDY, L. (1972): A guide for the identification of blue greens (Cyanophyta) in Hungary. (in Hungarian only). — Vizdok. (Budapest).

FELFÖLDY, L. (1976): A guide for the identification of green algae (Chlorococcales in Hungary (in Hungarian only). — Vizdok (Budapest).

FELFÖLDY, L. (1980): Biological water qualification (in Hungarian only). — Vízdok. (Budapest).

FELFÖLDY, L. (1981): Ecology of waters. General hydrobiology (in Hungarian only). — Publishing House of Agriculture, Budapest.

HINDÁK, F. (1975): Kluč na určovaňie výtrusnych rastlin I. diel. — Bratislava.

HORTOBÁGYI, T. (1939a): Qualitative studies on the phytoplankton of the "Nagyfa" backwater of the Tisza (in Hungarian). — Folia Cryptogamica (Szeged) *22*, 152—216.

HORTOBÁGYI, T. (1939b): Qualitative studies on the phytoplankton of the "Nagyfa" backwater of the Tisza (in Hungarian). — Folia Cryptogamica (Szeged) *3*, 151—208.

HORTOBÁGYI, T. (1941): Recent data on the qualitative analysis of the "Nagyfa" backwater of the Tisza (in Hungarian). — Bot. Közlem. *38*, 151—170.

HORTOBÁGYI, T. (1957): La représentation graphique des microphytocoénoses. — Revue Algol. *2*, 57—62.

HORTOBÁGYI, T. (1960): *Hyalophacus Tiszae* Hortob. N. sp. Data to the microvegetation of the Városnemény backwater of the Tisza (in Hungarian). — Egri Ped. Főisk. Évk. *6*, 393—398

HORTOBÁGYI, T. (1962): Examination of microorganisms on the basis of netted and dipped samples (in Hungarian). — Hid. Közlöny *2*, 162—170.
HORTOBÁGYI, T. (1963): Flora of waters (in Hungarian). — Gödöllő.
HUBER-PESTALOZZI, G. (1968): Das Phytoplankton des Süss Wassers, Teil 3. — Stuttgart.
KALBE, L. (1973): Kieselalgen in Binnengewassern. — Wittenberg Lutherstadt.
KISS, I. (1977): Variability of *Scenedesmus ecornis* (Ralfs.) Chod. in dead-arm of the river Tisza at Körtvélyes. — Tiscia (Szeged) *12*, 49—55.
KISS, J. (1978a): Algological investigations in the dead-arm at Lakitelek-Tőserdő. — Tiscia (Szeged) *13*, 27—47.
KISS, J. (1978b): Occurrence of *Synuta uvella* Ehr. var. *Tiszaiensis* N. var. in the dead-arm of the river Tisza near Lakitelek. — Tiscia (Szeged) *13*, 49—54.
KISS, J. (1979a): Algological investigations in the dead-arm of the river Tisza at Tiszaalpár and Tiszaug. — Tiscia (Szeged) *14*, 41—61.
KISS, J. (1979b): Seltene Strombomonas — Arten in den toten Armen der Tisza am mittleren und oberen Flusslauf. — Tiscia (Szeged) *14*, 63—70.
NÉMETH, J. (1980): A guide for the identification of Euglenophyta I. in Hungary (in Hungarian only). — Vízdok. (Budapest).
T. BARTALIS, É. (1978): Biological quality of water in the section of the Duna between Rajka and Nagymaros (in Hungarian). — Hidr. Közlöny *7*, 311—319.
UHERKOVICH, G. (1967): Neue und seltenere Algen aus der Theiss und zwe Altwässern der Theiss. — Tiscia (Szeged) *3*, 3—9.
UHERKOVICH, G. (1967): Über das Sommerplankton des Altwassers von Mártély. — Tiscia (Szeged) *3*, 13—20.
UHERKOVICH, G. (1968): Data of the knowledge of the potamophytoplankton of the Tisza. VI. To the question of the development of population maxima (in Hungarian). — Hidr. Közlöny *7*, 315—323.
UHERKOVICH, G. (1969): Data to the knowledge of the potamophytoplankton of the Tisza. VII. Special forms of population maxima (in Hungarian).
UHERKOVICH, G. Hidr. Közlöny *1*, 31—35.
UHERKOVICH, G. (1971): Phytoplankton of the Tisza (in Hungarian). — Szolnok.
UHERKOVICH, G. (1972): Taxonomische und ökonomische Übersicht der Chrysophyten-Organismen der Theiss. — Tiscia (Szeged) *7*, 13—28.
UHERKOVICH, G. (1975): Taxonomisch-ökonomische Übersicht der Chlorophyten-Rhodophyten-Schizomycophyten und Mycophyten-Organismen der Theiss und ihrer Nebengewässer. — Tiscia (Szeged) *10*, 15—37.
VÁMOS, R. (1972): Microbiological processes in flooded soils (in Hungarian, manuscript). — Szeged.

A mártélyi és körtvélyesi Tisza holtágak biológiai vízminősége 1976—1980 között, különös tekintettel a fitoplankton változására

DOBLER ENIKŐ és KOVÁCS KATALIN

Alsótiszavidéki Vízügyi Igazgatóság, Szeged, Magyarország

Kivonat

Dolgozatunkban beszámolunk a mártélyi és körtvélyesi holt ág biológiai vízminőségéről 5 éves adatsor alapján. (1976—1980. évek között havonkénti mintavétel.) A biológiai vizsgálatok elvégzésekor választ kaptunk arra a kérdésre, hogy a víztér halobitása, trofitása, szaprobitása és toxicitása milyen fokú. Részletesen foglalkoztunk a fitoplankton összetételének szezonális változásaival és a Tisza folyó áradásának a holtág fitoplanktonjára gyakorolt hatásával.

A fitoplankton minőségi és mennyiségi összetételét tekintve a Körtvélyesi holtág víztere változatosabb képet mutatott; az algaszámok általában nagyobbak, gyakrabban alakult ki robbanásszerű fajszám növekedés. A fitoplankton együttes analízisét az algaszám meghatározásával végeztük. Mindkét holtág jellemző planktontársulásait Hortobágyi T. által javasolt csillagdiagramon ábrázoltuk és ezt dolgozatunkban közöltük.

Biološka osobenost vode mrtvaja Tise Mártély i Körtvélyes u toku 1976—1980 godine sa posebnim osvrtom na dinamiku fitoplanktona

DOBLER ENIKŐ i KOVÁCS KATALIN

Vodoprivredna uprava donjeg područja Tise, Szeged, Hungaria

Abstrakt

U radu se prikazuje biološka osobenost kvaliteta vode mrtvaja Mártély i Körtvélyes na bazi petogodišnjih podataka (mesečni uzorci u toku 1976—1980). Biološkom analizom je utvrdjivan stepen halobitnosti, trofičnosti, saprobitnosti i toksičnosti vodenog basena. Posebna pažnja je posvećena sezonskoj dinamici sastava fitoplanktona u funkciji uticaja reke Tise na fitoplankton mrtvaja u zavisnosti od vodostaja.

U odnosu na kvalitativni i kvantitativni sastav fitoplanktona, mrtvaja Körtvélyes pokazuje veću raznovrsnost. Uopšte uzev broj algi je veći i češće su eruptivna povećavanja broja vrsta. Analiza zajednice fitoplanktona vršena je na osnovu utvrdjivanja broja algi. Karakteristične planktonske zajednice obe mrtvaje su obradjene i prikazane po metodi HORTOBÁGYI T.

БИОЛОГИЧЕСКОЕ КАЧЕСТВО ВОДЫ МАРТЕЛЬСКОЙ И КЕРТВЕЛЬЕШСКОЙ СТАРИЦ ТИСЫ 1976Ц1980 ГОДАХ, С ОСОБЫМ ВНИМЕНИЕМ НА СМЕНЫ В ФИТОПЛАНКТОНАХ

Е. Доблер и К. Ковач

Нижнетисянское водное управление, Сегед, ВНР

Резюме

В работе на основании 5-летних данных приводится ответ на биологическое качество воды Мартейевской и Кёртвейешской старицы. (На основании проб, взятых в 1976—1980 годах).

Биологические исследования показали в какой степени находится в приведенных водах галобичность, трофичность, сапрофичность и токсичность.

В деталях изучалась изучением сезонная смена составной части фитопланктонов, а также влияние разливов реки Тисы на фитопланктоны обеих стариц.

В качественных и количественных отношениях фитопланктоны воды старицы Кёртвейеша дали довольно изменчивую картину. Количество водорослей значительно ивеличилось. В отдельных случаях даже бурным способом. Общий анализ фитопланктонов в осовном закончили определением количества водорослей.

Типичные планктонные сообщества обеих стариц приведенные по сводной диаграмме, предложенной Тибором Гортобадьи, в научном труде.

Tiscia (Szeged) Vol. XVII, pp. 89—130 (1982)

TEN-YEAR CHANGES IN COMMUNITY STRUCTURE, SOIL AND HYDROECOLOGICAL CONDITIONS OF THE VEGETATION IN THE PROTECTION AREA AT MÁRTÉLY (S. HUNGARY)

GY. BODROGKÖZY

Department of Botany, Attila József University, Szeged, Hungary
(Received September 16, 1981)

Abstract

The studies reported here were concentrated mainly on the Körtvélyes holm of the landscape protection area at Mártély. It was set as an aim to clarify the relationships among plant associations developed here, the physical structure and moisture supply of their soils, the accumulation of sodium salts as well as the degree and duration of flooding. The submerged aquatic plant communities of the backwaters of different ages perished completely after the introduction of the herbivorous silver carp (Ctenopharyngodon idella). In the deepest section of the holm, on the hardest alluvial soil least permeable to water and longest exposed to stagnant waters *Glycerietum maximae, Leucanthemo serotino-Alopecuretum, Carici-Typhoidetum arundinaceae* developed. In the zone covered with stagnant water for a shorter period, *Carici melanostachyae-Alopecuretum,* and subsequent to it *Lythro virgatae-Alopecuretum pratensis* appeared. Between the terracelike formed dand dunes, in lastingly flooded zone, the weed community of *Echinochloo-Bidentetum* occurs, and on the alluvials of the riverside *Elatini-Eleocharition ovatae* association grows. To elucidate their hydroecological conditions, each of the ten categories was divided into 3 subgroups by further improving the system proposed by ELLENBERG, and later that of ZÓLYOMI et al. In this way 30 intracategory subunits were separated by means of hydroecological graphs constructed for their species components. The species most sensitive to lasting flooding (2—4 m water depth) (duration: 2—4 weeks) is *Typhoides arundinacea,* while *Glycyrrhiza echinata* and in a lesser degree *Lythrum salicaria* can least tolerate the shading effect of small forests.

Introduction

The original vegetation of the Tisza valley has suffered great alterations since the construction of the flood protection dyke systems. Nowadays this area can be divided to the flood-plain inside the embankment and the protected parts of the previous flood-area outside it.

The flow rate of the passing flood restricted to a rather narrow flood-plain was greatly increased by the short cuts of river sections resp. the regulation of the river bed. The greatest part of the embanked area on the protected side of the dams became agricultural resp horticultural tillage. As a result of that, the ancient vegetation of marshes and meadows along the Tisza as well as the riverside gallery forests are now mostly things of the past. The composition of the plant cover in the flood-plain between the protecting dams has been exhibiting great changes. This pertains particularly to our experimental area, the Körtvélyes holm, which is one of the lowest-lying areas of the river valley. During periods of flooding, it is often covered by a

2—4 m high mass of water. At the same time, the floods occur at rather uncertain intervals. Sometimes there is no flood, and sometimes it occurs more than once during the vegetation period. These floodings affect the species composition of aquatic, meadow- and marsh-phytocenoses.

Our goal was to follow up these changes, to explore principally the physical, chemical and hydroecological conditions between them. Since the area surrounded by the river itself and the backwater is generally not exposed to anthropogenic effects, it was thought desirable to maintain it as a reservation. In this way the investigations reported here are also of interest from the aspect of nature conservation.

Materials and Methods

The main intention was to determine the communities occurring in this area, to tabulate and range them into the cenological system. Instead of the numerical listing of the percentages of D values in the tables, the graphical illustration of data was chosen to make the survey easy and fast.

To establish their phytomass production, experimental parcels were allocated. These contained the most important zones of vegetation. Earlier results in this field have already been reported (Bodrogközy and Horváth 1977, 1979). Since here the different hydroecological effects of floods, resp. stagnant waters remaining behind after the flood waves manifest themselves, it was thought necessary to categorize the species of the single associations and their smaller units according to water demand resp. water tolerance. Moreover, it was also found desirable to range them into smaller groups inside the single categories. The generally adopted Ellenberg system (1952) which was adapted to conditions existing in our country by Zólyomi et al. (1967), was further improved in the interest of these investigations. After all, it became possible to differentiate 30 hydroecological varieties inside the 10 categories. To make the procedure more simple, the hydroecological categories were marked with their abreviated names and the varieties with numbers. In the case of the latter the character species were marked with number 2, the species belonging to the former resp. next category with numbers 1 and 3 (hd 1 and sx 3 represent extreme values).

To make hydroecological determinations more exact, a hydroecological graph resp. curve was constructed for each species recovered during this study. This could be solved partly on the basis of results and experiences obtained during my 30-year investigations on the Tisza, partly on that of pertaining literary data, first of all Soó's work (1964—1980). The narrower the hydroecological demand of a species, the higher the percentual value indicated by the climactic point of its graph (generally in excess of 50%). The comparison of Figs. 1B and 12A well exemplifies this.

Of the environmental biological factors, the ecological situations of the soil of water supply indicator phytocenoses should also be cleared. The importance of this was pointed out by Eskuche (1963). It is essential to know the distribution of soil fractions principally influencing dead water content and water permeability. With a view to this, six fractions were separated by using the hydrometer technique. In this way we could determine the percentual ratios of two sand, two silt and two clay fractions.

The determinations of organic matter and $CaCO_3$ contents, pH, and the amount of sodium salts were performed parallel with these analyses. The seasonal changes of water supply in the soil profiles of the single communities were also investigated. In the course of that the changes were considered from 3 aspects: moisture content in the percentage of dry resp. wet soil weight and moisture content expressed in liter. dm^{-3} unit.

For the sake of a better survey, the results of the soilecological investigations of the single plant communites are illustrated by monolithical, three-dimensional graphs.

Hydroecological categories

hydatophytes, growing in aquatic environment	hd	1 2 3	*Lemna* type *Ceratophyllum* type *Nymphaea* type
hydato-helophytes growing in aquatic, marshy environment	hhe	1 2 3	*Hottonia palustris* type *Butomus umbellatus* type *Iris pseudacorus* type
helophytes growing in marshy environment	he	1 2 3	*Carex gracilis* type *Lysimachia vulgaris* type *Teucrium scordium* type
helo-hygrophytes growing in damp environment	hhg	1 2 3	*Eleocharis palustris* type *Carex melanostachya* type *Thalictrum flavum* type
hygrophytes growing in fresh environment	hg	1 2 3	*Carex hirta* type *Galium rubioides* type *Poa trivialis* type
hygro-mesophytes growing in drying environment	hgm	1 2 3	*Alopecurus pratensis* type *Chenopodium polyspermum* type *Polygonum lapathifolium* type
mesophytes in medium dry environment	m	1 2 3	*Inula britannica* type *Lolium perenne* type *Chenopodium album* type
meso-xerophytes growing in dry habitat	mx	1 2 3	*Galium verum* type *Poa angustifolia* type *Euphorbia cyparissias* type
asteno-xerophytes growing in dryer habitat	ax	1 2 3	(*Poa bulbosa* type) (*Bothriochloa ischaemum* type) (*Thymus marschallianus* type)
steno-xerophytes growing in very dry habitat	sx	1 2 3	(*Potentilla arenaria* type) (*Koeleria glauca* type) (*Euphorbia seguieriana* type)

This implies that it became necessary to differentiate 10 categories in this system. Since each species can be ranged into one of these, the groups of indifferent species are no more of importance and can be eliminated. The single sub-groups can be also regarded as hydroecological types. Their type species occur along the Tisza. Since the asteno- and stenoxerophytes do not occur there, their name-giving species were put into parenthesis.

Cenosystematics of the vegetation units in the landscape protection district investigated

(Compilation according to Soó's system, with allowance for conditions of zonation)

LEMNO-POTAMEA Soó 68
Hydrochari-Lemnetea OBERD. 68
Hydrocharietalia RÜBEL 33
(Syn.: Lemnetalia W. KOCH et TX ex OBERD. 57)
Lemnion minoris W. KOCH et TX ex OBERD. 57

(Syn.: Lemnion trisulcae DEN HARTOG et SEGAL 64)

1. *Wolffietum* MYAW. et TX 60
— wolffietosum arrhizae, typicum
— potamogetosum lucentis
— polygonetosum amphibii
2. *Salvinio-Spirodeletum polyrrhizae* MAYAW. et TX 60
(Syn.: Lemno-Spirodeletum salvinietosum W. KOCH 54)

POTAMOGETONETEA TX et PRSC. 42
Potamogetonetalia W. KOCH 26
Ranunculion fluitantis NEUH. 59
(Syn.: Callitricho-Batrachion DEN HARTOG et SEGAL 64)

3. *Ranunculeto trichophylli-Callitrichetum cophocarpae* (Soó 27)

(Syn.: Batrachio trichophylli-Callitrichetum Soó/27/60
Ranunculetum trichophylli Soó 27/Soó/27/60
Potameto-Callitrichetum BALÁZS 42)
— — ranunculetosum typicum Soó 57)
Nymphaeion
4. *Trapetum natantis* MÜLL. et GÖRS 60
Magnopotamion WOLLMANN 47
5. *Potamogetonetum lucentis* HUECK 31

ISOËTO-NANOJUNCETEA BR.-BL. et TX 43
Cyperetalia fusci (KLIKA 35) MÜLL.-ST. et PIETSCH 61
Elatini-Eleocharition ovatae PIETSCH 73
6. *Dichostylidi-Gnaphalietum uliginosi* (HORVATIĆ 31) Soó et TIM. 47
(Syn.: Dichostyletum michelianae Soó 40)
— gnaphalietosum uliginosi, typicum
— crypsidetosum aculeatae
— heleochloetosum schoenoidis
7. *Cypereto-Juncetum bufonii* Soó et CSÜRÖS (44) 47
— cyperetosum fusci, typicum
— potentilletosum supinae
— xanthietosum italici

CYPERO-PHRAGMITEA Soó 68
PHRAGMITETEA TX. et PRSC. 42
Phragmitetalia W. KOCH 26
Phragmition communis W. KOCH 26
8. *Scirpo-Phragmitetum austro-orientale* Soó 57

9. *Glycerietum maximae* HUECK 31
10. *Typhoidetum arundinaceae* EGGER 33
(Syn.: Phalaridetum arundinaceae
Baldingeretum arundinaceae Soó 47)
11. *Leucanthemo serotino-Phragmitetum* Soó 71
— phragmitetosum, typicum
— calystegietosum

Magnocaricetalia PIGN. 53
Magnocaricion elatae W. KOCH 26
B. *Caricion gracilis* BAL.-TUL. 63
12. *Carici gracilis-Typhoidetum arundinaceae* Soó 71
(non Agrostio-Typhoidetum, Phalaridetum ass.)
— typhoidetosum, typicum
13. *Caricetum gracilis* (ALM. 29; GRAEB. et HUECK 31) TX. 37
(Syn.: Caricetum gracilis-nutantis Soó 40)
— caricetosum gracilis, typicum
— bolboschoenetosum maritimi

MOLINIO-ARRHENATHEREA Soó 68
Molinio-Juncetea BR.—BL. 49
Molinietalia W. KOCH 26
Alopecurion pratensis (PASSARGE 46) Soó 71
(Syn.: Agropyro-Alopecurion pratensis MORAVEĆ 64)
14. *Carici-Alopecuretum pratensis* Soó 71.
(Syn.: Alopecuretum pratensis hung. (Now. 28) Soó 57
Alopecureto-Festucetum pratensis UBR. 55)
— caricetosum melanostachyae, typicum
— bolboschoenetosum maritimi
— alopecuretosum pratensis
15. *Lythro virgatae-Alopecuretum pratensis* BODRK. 77
(Syn.: Alopecuretum pratensis hung. normale
Agrosteto-Alopecuretum pratensis UBR. 55)
— alopecuretosum pratensis, typicum
— glycyrrhizetum echinatae
— poetosum angustifoliae
16. *Poo angustifoliae-Alopecuretum pratensis* (EGGLER 59) BODRK. 62
(Syn.: Alopecuretum pratensis hung. poetosum angustifoliae BODRK. 62)

CHENOPODIO-SCLERANTHEA HADAČ 67
Secalietea BR.—BL. 31
Eragrostetalia J. TX. 61
Consolido-Eragrostion
17. *Digitario-Portulacetum oleraceae* (FELF. 42) TIM. et BODRK. 55

CHENOPODIETEA BR.—BL. 51
Chenopodietalia TX. et LOHM. 50
Convolvulo-Agropyrion repentis GÖRS. 66
18. *Agropyro-Convolvuletum arvensis* FELF. 43
— agropyretosum repentis
— rubetosum caesii

GALIO-URTICETEA Soó 71

Calystegietalia Tx. 50

Calystegion sepium Tx. 47

19. *Bidenti-Calystegietum* Felf. 43
    — calystegietosum, typicum
    — bidentetosum tripartitae

BIDENTETEA TRIPATITAE Tx., Lohm. Prsg. 50

Bidentetalia Br.-Bl et Tx. 43

Bidention tripartitae Nordh. 40

20. *Echinochloo-Bidentetum tripartitae* Soó 71
    — bidentetosum, typicum
    — echinochloetosum
21. *Echinochloo-Heleochloetum alopecuroidis* (n. nov)
    (Syn.: Cyperio-Spergularion: Heleochloetum alopecuroidis (Rapcs. 27) Ubr. 48)
    — heleochloetosum alopecuroidis
    — agrostetosum stoloniferae
    — portulacetosum oleraceae

Chenopodion rubri Br.-Bl.

22. *Echinochloo-Polygonetum lapathifolii* (Ujv. 40) Soó et Csürös (40) 47

PLANTAGINETEA MAJORIS Tx. et Prsg. 50

Plantaginetalia Tx. (47) 50

Agropyro-Rumicion crispi Nordh. 40

23. *Lolio-Alopecuretum pratensis* Bodrk. 62

Detailed evaluation

1. *Wolffietum arrhizae* Myam. et Tx. 60
(Syn.: Wolffio-Lemnetum gibbae Berh. 43)

Occurrence :It forms large stands in some places in the backwaters of the landscape protection district. It often occurs among other floating resp. submerged aquatic plant stands delivered there by the waves. In this way, it does not occur only in the inner, deep-water sections of backwaters, but in the littoral, too, where it forms various stands of transitory nature. Since the introduction of herbovirous fish into these waters, this association together with the other aquatic plants has disappeared completely. In the last years after the fish were caught, it has regenerated.
Character species: *Wolffia arrhiza* and *Lemna gibba.* The latter is very rare in this area.

Subassociations:

— wolffietosum, typicum

It often dforms pure stands in the deeper sections of the backwaters (Finta 1979).

— potametosum lucentis

Its differential species is the *Potamogeton lucens* L. (hd 2 type). The occurrence is similar to the previous wolffietosum subassociation but in other places it shows transition to large aquatic plant communities.

— polygonetosum amphibii

Differential species are *Myriophyllum spicatum* L., *Ceratophyllum demersum* L. (also belonging to the hd 2 type), but principally the *Polygonum amphibium* L. f. aquaticum LEYSS (hd 3 type). It occurs particularly in the drying sections of the backwaters. *Polygonum* can best adapt itself to drying (see other details in Table 1 and Fig. 1-A).

Table 1. *Wolffietum arrhizae*

Life form	Acidity of soil	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Wolffietosum	Potamogetosum lucentis	Polygonetosum amphibii
						Hydatophyta				
HH	R 0	T 0	F 5	N ?	hd 1	*Wolffia arrhiza*	Lemnion	25—50%	25—50%	5—25%
HH	R 0	T 0	F 5	N ?		*Spirodela polyrrhiza*	Lemnion	5—25%	5—25%	
HH	R 0	T 0	F 5	N ?		*Lemna minor*	Lemno-Potametea	5—25%	5—25%	
HH	R 4	T 2	F 5	N ?	hd 2	*Myriophyllum spicatum*	Potamion	0.5—1%	0.5—1%	5—25%
HH	R 4—5	T 5	F 5	N ?		*Ceratophyllum* demersum	Potametalia			5—25%
HH	R 4	T 3	F 5	N ?		*Potamogeton lucens*	Potamion		25—50%	0.5—1%
HH	R 0	T 0	F 3—5	N 0	hd 3	*Polygonum amphibium* var. *aquaticum*	Phragmitetea	0.5—1%		25—50%
						Hydato-helophyta				
HH	R 0	T 0	F 5	N 3	hhe 3	*Alisma plantago-aquatica*	Phragmitetea			0.5—1%
HH	R 4—3	T 3	F 4—5	N 3		*Glyceria maxima*	Phragmition	0.5—1%		0.5—1%

Symbols: D-value

25—50%
5—25%
1—5%
0.5—1%

(The symbols apply to tables 1—14)

2. *Salvinio-Spirodeletum polyrrhizae* W. KOCH 54.
(Syn.: Lemno-Spirodeletum salvinietosum W. KOCH 54)

Occurence: It is most frequent in the littoral zone of the backwaters in this district, when the zone of aquatic macrophytes is missing as a consequence of the increased culture effects, particularly industrial fishing. Its stands together with the former one are drifted away by inundations recurring more than once in one year. In flood-free periods, however, it regenerates rapidly.
Character species are *Salvinia natans* (L.) ALL., *Spirodela polyrrhiza* (L.) SCHLEIDEN, each of them belonging to the hd 1 type.

Subassociations:

— salvinietosum, typicum

Hd 1 species of Hydrocharition and species of Lemnion and Lemno-Potamea dominate. The other species occur individually, their contributions to cover is small.

— hydrocharetosum

Besides the previous species, the type hd 1 *Hydrocharis morsus ranae* L. is its differential species, but species of hd 3, hhe 2 and 3 types are also essential. Thus e.g. *Schoenoplectus lacustris* (L.) PALLA, *Bolboschoenus maritimus* (L.) PALLA also mingles with its stand, when drifted into the littoral zone (Table 2, Fig. 1-A).

Table 2. *Salvinio-Spirodeletum*

Life form	Acidiy of soil	Temperature	Water demand	N-demans	Hydroecological character	Species	Character species	Salvinietosum	Hydrocharietosum
						Hydatophyta			
HH	R 0	T 0	F 5	N ?	hd 1	*Salvinia natans*	Hydrocharicion	▬	▬
HH	R 0	T 0	F 5	N ?		*Spirodela polyrrhiza*	Lemnion	▬	▬
HH	R 3	T 3	F 5	N ?		*Hydrocharis morsus ranae*	Lemno-Potamea	▬	▬
HH	R 0	T 0	F 3—5	N 0	hd 3	*Polygonum amphibium* var. *aquaticum*	Phragmitetea	—	▬
HH	R 3—2	T 3—4	F 5	N ?		*Trapa natans*	Nymphaeion		—
						Hydato-helophyta			
HH	R 3—4	T 0	F 4—5	N 2—3	hhe 2	*Schoenoplectus lacustris*	Phragmition		▬
HH	R 0	T 3	F 5	N 3		*Butomus umbellatus*	Phragmitetea	—	
HH	R 3—4	T 0	F 4	N 2	hhe 3	*Bolboschoenus maritimus*	Bolboschoenion		▬
						Helophyta			
HH	R 0	T 0	F 5	N 3	he 1	*Typha latifolia*	Phragmitetea	—	
HH	R 3—4	T 0	F 0	N 3—4		*Phragmites australis*	Phragmitetea	—	—
HH	R 3	T 2—3	F 4	N 2—4		*Carex gracilis*	Magnocaricion		—
HH	R 0	T 3	F 5	N 2		*Oenanthe aquatica*	Phragmitetalia	—	
HH	R 0	T 2	F 3—4	N 0—3	he 2	*Lysimachia vulgaris*	Molinio-Juncetea		—
HH	R 3—4	T 3	F 5	N 2—3		*Sium latifolium*	Phragmition	—	—

3. *Ranunculo trichophylli-Callitrichetum cophocarpae* Soó (27) 60
(Syn.: Batrachio trichophyllo-Callitrichetum (Soó 27) 60
Ranunculetum trichophylli Soó 27
Potameto-Callitrichetum BALÁZS 42)

Occurrence: It is found occasionally in the lower-lying areas with stagnant water in our district, in the place of the perished stands of *Carici-Typhoidetum*. It is carried there by floods. In other instances it forms the lower synusium of the stands of *Carici-Typhoidetum*. It is rare in the backwaters. After the drying of stagnant waters it can persist for a longer period on the damp alluvial soil in "terrestris" form.
Character species: hd 2 *Ranunculus radians* RÉVEL var. *godronii* A. et G., *R. trichophyllus* (CHAIX in VILL) V. D. BOSCH. Its stands consist generally of a few species which belong partly to Ruppion, Potametalia, resp. Lemno-Potamea.

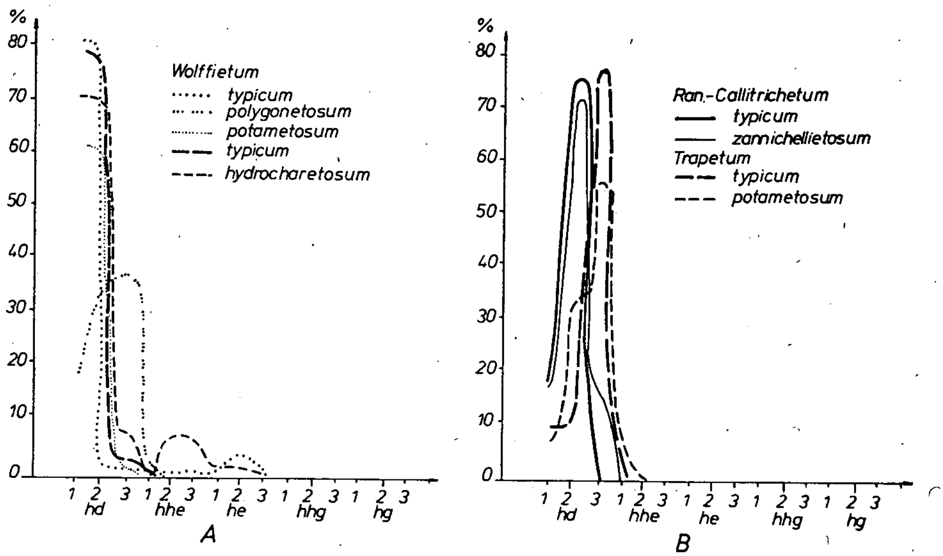


Fig. 1. Graphical illustration of the hydroecological conditions of four aquatic plant communities

Subassociations:

— ranunculetosum radiantis, typicum
— zannichellietosum

Differential species: hd 2 *Zannichellia palustris* L. var. *pedicellata*. The contributions of the single species to cover are seen in Table 3. The percentual values for total cover according to hydrological categories are presented in Fig. 1-B.

4. *Trapetum natantis* MÜLL. et GÖRS 60
(Syn.: Nupharo-Castalietum trapetosum TIM. 54)

Occurrence: It was the most frequent and common water plant community in the backwaters of the area before the introduction of herbivorous fishes. Today it is still sporadic, its considerable spread can be expected only in places where the sections of the backwaters are no more suitable for industrial fishery for sedimentation (lack

Table 3. *Ranunculo trichophyllo-Callitrichetum*

Life form	Acidity of soil	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Ranunculetosum radiantis	Zannichellietosum
						Hydatophyta			
HH	R 0	T 0	F 5	N ?	hd 1	*Cladophora glomerata*	Lemno-Potamea (?)	■	■
HH	R 2—4	T 3	F 5	N ?	hd 2	*Ranunculus radians* v. *godronii*	Ruppion	■	■
HH	R 0	T 2	F 5	N ?		*Ranunculus trichophyllus* ssp. *rionii*	Potametalia	■	■
HH	R 3—4	T 0	F 5	N 3		*Zannichellia palustris* var. *pedicellata*	Ruppion		■
HH	R 0	T 0	F 3—5	N 0	hd 3	*Polygonum amphivium* v. *aquatilis*	Phragmitetea	—	■
						Helophyton and Helo-hygrophyton			
HH	R 3	T 2—3	F 4	N 2—3	he 1	*Carex gracilis*	Magnocaricion		—
HH	R 0	T 0	F 4—5	N 2—3	hhg 1	*Eleocharis palustris*	Phragmitetea		—

of silver carp). In some undisturbed sections it forms a mosaic complex with stands of *Nymphaeetum albae*.

Character species: Type hd 3 *Trapa natans* L. and *Polygonum amphibium* L. f *aquaticum* LEYSS.

Subassociations:

— trapetosum natantis, typicum
— potametosum lucentis

Its differential species are the two species of Potamion, the *Potamogeton lucens* L. and *Lemna trisulca* L. both belonging to hd 2 type. It shows transition to Potametum lucentis, but is not identical with it (cf. Fig. 1-B in Table 4).

5. *Potametum lucentis* HUECK 31
(Syn.: Myriophyllo-Potametum lucentis Soó 57)

Occurrence: It is the most common submerged aquatic plant community not only in our area but also in the other standing waters of the valley of the Tisza. It thrieves well also in the shallow clay-ditches along the temporarily drying out protecting dykes. It is resistant to the damaging effect of the gley soil.

Character species: type hd2 *Potamogeton lucens* L. and *Myriophyllum spicatum* L.

Table 4. *Trapetum natantis*

Life form	Acidity of soil	Temperature	Water demand	N-demans	Hydroecological character	Species	Character species	Trapetosum	Potamogetosum lucentis
				Hydatophyta					
HH	R 0	T 2	F 5	N ?	hd 1	*Lemna minor*	Potamion	▬	▬
HH	R 4	T 0	F 5	N ?	hd 2	*Lemna trisulca*	Lemno-Potamea		—
HH	R 4	T 2	F 5	N ?		*Myriophyllum spicatum*	Potamion	▬	▬
HH	R 4	T 3	F 5	N ?		*Potamogeton lucens*	Potamion		▬
HH	R 0	T 0	F 3—5	N 0	hd 3	*Polygonum amphibium* var. *aquaticum*	Phragmitetea	▬	▬
HH	R 3—2	T 3—4	F 5	N ∅		*Trapa natans*	Nymphaeion	▬	▬
				Hydato-helophyta					
HH	R 0	T 3	F 5	N 3	hhe 2	*Butomus umbellatus*	Phragmitetea		—
HH	R 3—4	T 3	F 5	N 3	hhe 3	*Sagittaria sagittifolia*	Phragmition		—
HH	R 0	T 0	F 5	N 3		*Alisma plantago-aquatica*	Phragmitetea	—	
HH	R 4—3	T 2—3	F 4	N 2—3		*Glyceria maxima*	Phragmition		—
				Helo-hygrophyta					
HH	R 0	T 0	F 4—5	N 2—3	hhg 1	*Eleocharis palustris*	Phragmitetea		—

Subassociations:

— potametosum lucentis, typicum

Its pure stands often occur together with a few acessory species.

— trapetosum natantis

Its stands form a transition to Trapedium community. Its differential species are *Trapa natans* L. (hd3), *Myriophyllum spicatum* L. and *Ceratophyllum demersum* L. (hd 3).

These floating and submerged aquatic plant communities living in standing waters, do not reveal great differences in the various sections of the Tisza valley (Timár 1950, 1954, Timár and Bodrogközy 1969); the richest and most beautiful stands occurred in backwaters near Tiszafüred before the construction of the Tisza II (Kisköre) Reservoir (Bodrogközy 1965).

6. *Dichostylidi-Gnaphalietum uliginosi* (Horvatić 31) Soó et Tim. 47
(Syn.: Dichostyleto michelianae Soó 40)

Occurrence: It is very common in the littoral zone of the river, not only in our investigation area but in other places, as well. It is a mud-living plant community with short growing season (Timár 1950, Timár and Bodrogközy 1969). Its stands

Table 5. *Potametum lucentis*

Life form	Acidity of soil	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Potamogetosum lucentis	Trapetosum natantis
						Hygatophyta			
HH	R 3	T 3	F 5	N ?	hd 1	*Hydrocharis morsus-ranae*	Lemno-Potamea	—	■
HH	R 0	T 0	F 5	N ?		*Spirodela polyrrhiza*	Lemnion	—	—
HH	R 4	T 3	F 5	N ?	hd 2	*Potamogeton lucens*	Potamion	■	■
HH	R 4	T 2	F 5	N ?		*Myriophyllum spicatum*	Potamion	■	■
HH	R 3—4	T 3	F 5	N ?		*Potamogeton perfoliatus*	Potamion	■	
HH	R 4—5	T 2	F 5	N ?		*Ceratophyllum demersum*	Potamion		■
HH	R 0	T 0	F 3—5	N 0	hd 3	*Polygonum amphibium* var. *aquatilis*	Phragmitetea		—
HH	R 3—2	T 3—4	F 5	N ?		*Trapa natans*	Nymphaeion		■
						Hydat-helophyton and helophyton			
HH	R 4—5	T 2	F 5	N ?	hhe 3	*Glyceria maxima*	Phragmition		—
HH	R 3—4	T 0	F 5	N 0	he 2	*Rorippa amphibia*	Phragmitetea		—

are made up mainly of ephemeral species. During recurring summer floods, however, the sandy alluvial soil of river banks remain without vegetation. Its seeds resp. fruits are delivered by river water to the shore in variable amounts and condition whereby the single mud plant communities may form mosaic-like complexes. Transition to *Cypero-Juncetum, Crypsidetum aculeatae* and *Chenopodietum rubri* can also occur.

Character species: *Dichostylis micheliana* (L.) NEES, *Potentilla supina* L., *Gnaphalium uliginosum* L., *Botrydium granulatum* L. belonging to the he 3 type.

Subassociations:

— gnaphalietosum uliginosi, typicum

Differential species: *Gnaphalium uliginosum* L., *Chlorocyperus glomeratus* (TORN) PALLA. — It is the most common variety of the association in our area. From hydroecological aspect its species belong almost excusively to the he 3 type (Table 6).

— crypsidetosum aculeatae

It shows transition to *Crypsidetum aculeatae*, but is not identical with it. — Its differential species is the type hhg 1 *Crypsis aculeata*. The *Crypsidetum* has two ecotypes: (a) the *Halo-Crypsidetum aculeatae* BODRK. 67 occurring on slightly sodic solonchak soil and (b) *Crypsidetum aculeatae* BOJKO 32 growing on alluvial mud along the river with easily differentiable character species. In these stands the *Juncus effusus* L. (hhg 1) and *Ranunculus sceleratus* L. (hhg 2) are also characteristic.

Table 6. *Dichostylidi-Gnaphalietum uliginosi*

Life form	Acidity of soil	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Gnaphalietosum uliginosi	Crypsidetosum	Heleochloetosum schoenoidis
				Helophyta						
HH	R 0	T 2	F 4—5	N 2	he 2	*Veronica anagallis-aquatica*	Cyp.-Spergularion		—	
Th	R 2—3	T 0	F 3—4	N 2	he 3	*Gnaphalium uliginosum*	Nano-cyperion	▬	▬	▬
Th	R 3	T 3—4	F 4	N 2—3		*Dichostylis micheliana*	Nano-cyperion	▬	▬	—
Th	R 3—2	T 3	F 5	N 2—3		*Potentilla supina*	Nano-cyperion	▬	▬	▬
H	R 3	T 3—4	F 4	N ?		*Chlorocyperus glomeratus*	Nano-cyperion	—		
						Botrydium granulatum	Nano-cyperion	—		
			Helo-hygrophyta and Hygrophyt							
Th	R 4	T 4	F 2—4	N 1	hhg 1	*Crypsis aculeata*	Cyperio-Spergularion		▬	—
H	R 2—3	T 0	F 4	N 3		*Juncus effusus*	Junco-Molinietea		—	
H	R 3	T 2—3	F 4	N 3	hhg 2	*Alopecurus geniculatus*	Agrostion			▬
Th	R 0	T 1	F 5	N 4		*Ranunculus sceleratus*	Bidention		—	
Th	R 0	T 0	F 3	N 3—4		*Chenopodium rubrum*	Bidentetea		▬	—
H	R 3	T 2	F 4—5	N 2	hhg 3	*Veronica beccabunga*	Glyc.-Sparganion	—		
Th	R 4	T 4	F 2—4	N 1		*Heleochloa schoenoides*	Cyperio-Spergularion		—	▬
Th	R 0	T 3	F 3—4	N 3—4		*Bidens tripartita*	Bidentetea		—	▬
H	R 0	T 3—4	F 4	N 3	hg 1	*Mentha pulegium*	Agr.-Rumicion		—	
Th	R 0	T 3	F 3	N 3	hg 3	*Polygonum mite*	Bidentetea	—	—	—

While the former subassociation occurs principally on sandy alluvial soil, the latter one is found on surface alluvial mud of high colloid content, but still devoid of sodium salts.

— helochloetosum schoenoidis

It is found in very similar situations to the former subassociation, which means that the hhg 3 *Heleochloa schoenoides* (L.) HOST figuring here as differential species can become association-forming on the drying sodaic mud-covered depressions of slightly solonchak soil; *Halo-Heleochloetum schoenoidis,* its other ecotype occurs on muddy, non-sodaic alluvial soil along the streams and shows transition to the *Dichostylidi-Aloperuretum geniculatae.*

7. *Cypereto-Juncetum bufonii* Soó et Csürös (44) 47

Occurrence: It is less frequent than the former association. It is much rather the stand of the muddy alluvial soil in areas covered with stagnant water than that of the mud vegetation along the river. It will survive until it is supplanted by other associations rich in hemicryptophytes.

Character species: They are also the character species of its subassociations

— cyperetosum fusci, typicum

Its differential species are the *Cyperus fuscus* L., and *Juncus bufonius* L. (both hhg 2).

— potentilletosum supinae

Differential species are he 3 *Potentilla supina* L., *Chlorocyperus glomeratus* (Törn) Palla. The occurrence of hg 2 *Echinochloa crus-galli* (L.) P. B. is suggestive of the area getting weedy in places.

— xanthietosum italici

Table 7. *Cypereto-Juncetum bufonii*

Life form	Acidity of soil	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Cyperetosum fusci	Potentilletosum supinae	Xanthietosum italici
						Helophyta				
HH	R 3—4	T 0	F 0	N 3—4	he 1	*Phragmites australis*	Phragmitetea			
Th	R 3—2	T 3	F 5	N 2—3	he 3	*Potentilla supina*	Nano-cyperion			
Th	R 3	T 3—4	F 4	N ?		*Chlorocyperus glomeratus*	Nano-cyperion			
						Helo-hygrophyta				
Th	R 0	T 3	F 4	N 3	hhg 2	*Cyperus fuscus*	Nano-cyperion			
Th	R 3—2	T 0	F 3	N 3—4		*Juncus bufonius*	Nano-cyperetalia			
Th	R 0	T 3	F 3—4	N 3—4	hhg 3	*Bidens tripartita*	Nano-cyperion			
						Hygrophyton and Hygro-mesophyta				
Th	R 0	T 0	F 3	N 3—4	hg 2	*Echinochloa crus-galli*	Chenopodietea			
H	R 0	T 0	F 3—5	N 0	hgm 1	*Polygonum amphibium* var. *terrestris*	Phragmitetea			
Th	R 0	T 3—4	F 3	N 3—4		*Xanthium italicum*	Bidentetea			
Th	R 0	T 3	F 3—4	N 4	hgm 2	*Chenopodium polyspermum*	Pol.-Chenopodion			

The most frequent form of *Cypereto-Juncetum* in the district. Its differential species is the hgm 1 *Xanthium italicum* MORETTI possessing a wide hydroecological adaptability. The prickly fruit of this plant is uniformly spread by flooding water. A species belonging to the hgm 2 type is *Chenopodium polyspermum* L. — Facies-forming is *Polygonum amphibium* L. f. *terrestre* LEYSS. (cf. Table 7). The places in the hydroecological categories of the two mud plant associations are nearly identical. Thus the graphs for their contributions to total cover according to categories culminate between he 3 and hhg 3. Owing to their narrow ecological amplitude these highest points can even attain the level of 60—80% (Fig. 2). PIETSCH (1965, 1973) who is well acquainted with the conditions in Hungary has analyzed the Isoeto-Nanojuncetea communities in Europe with special regard to their proper place in the cenological system.

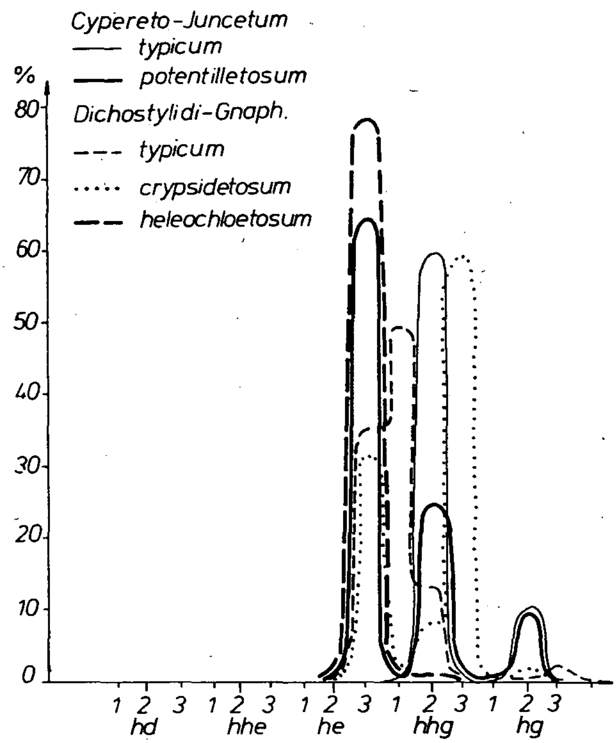


Fig. 2. Comparative graphical illustration of the hydroecological conditions of two mud plant communities.

8. *Scirpo-Phragmitetum austro-orientale* SOÓ 57
(Syn.: Scirpo-Phragmitetum W. KOCH 26 medioeuropaeum TX. 41)

Occurrence: Common in the littoral of backwaters.
Character species in our area are hhe 2 *Butomus umbellatus* L., *Schoenoplectus lacustris* (L.) PALLA, he 2 *Sium latifolium* L. and *Rorippa amphibia* (L.) BESS.; when

passing from the shore the hd 3 *Polygonum amphibium* L. f. *aquaticum* LEYSS. can become more abundant in its stands. The species composition of these reeds is generally poor, which is likely to be due to the low nutrient status of the sediment.

9. *Glycerietum maximae* (NOWINSKY 28) HUECK 31
(Syn.: Scirpo-Phragmitetum W. KOCH 26 glycerietosum aquaticae Soó 57)

Occurrence: It is found principally beyond the reeds or replacing them in the area of the Körtvélyes holm. It often forms pure stands also in shallow backwaters. In other places it forms a mosaic complex with Schoenoplectetum lacustris, resp. *Typhetum latifoliae* and *Typhoidetum arundinaceae*; occasionally its forms of transition can be observed. Similar *Glycerietum* communities were found in the region of Central Hessen (KNAPP and STOFFER 1962).

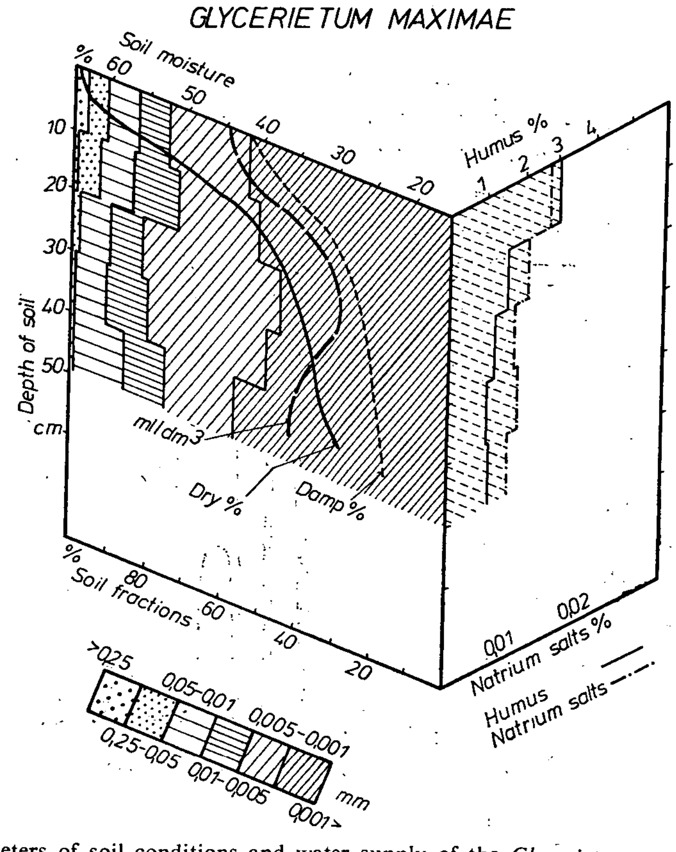


Fig. 3. Parameters of soil conditions and water supply of the *Glycerietum*-community in the autumnal aspect.

10. *Typhoidetum arundinaceae* EGGLER 33
(Syn.: Phalaridetum arundibaceae LIBBERT 31. Baldingeretum arundinaceae Soó 47)

Occurrence: In the shallow backwaters it forms larger or smaller patches behind the *Glycerietum* stands in the littoral zone. Its transition to the more rich *Carici gracilis-Typhoidetum arundinaceae* was often observed. The rapid spread of the species of *Typhoidetum* and *Glycerietum* during lasting floodings can be explained also by their vegetative reproduction (Kopecký 1960, 1965). Its spread in Central Europe and its zonation conditions were investigated by Kopecký (1967a, 1976).

11. *Leucanthemo serotini-Phragmitetum communis* Soó (57) 71
(Syn.: Chrysanthemo serotini-Phragmitetum Soó 57)

Occurrence: Just as in the other areas of the valley of the Tisza, it is found in the flat water-covered depressions, and sections filled temporarily with stagnant water in the landscape protection district, forming larger or smaller stands there. On the

Table 8. *Leucanthemo serotino-Phragmitetum*

Life form	Acidity of soil	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Phragmitetosum	Calystegietosum
						Hydato-helophyta			
HH	R 3—4	T 0	F 3	N 3	hhe 2	*Typhoides arundinacea*	Glycerio-Sparganion		
HH	R 0	T 3	F 5	N 3		*Butomus umbellatus*	Phragmitetea		
HH	R 3—4	T 0	F 4	N 2	hhe 3	*Bolboschoenus maritimus*	Bolboschoenion		
HH	R 0	T 2	F 4—5	N 3		*Iris pseudacorus*	Phragmitetea		
HH	R 4—5	T 3	F 4—5	N 3		*Glyceria maxima*	Phragmitetea		
						Helophyta			
HH	R 3—4	T 0	F 0	N 3—4	he 1	*Phragmites australis*	Phragmitetea		
HH	R 0	T 0	F 5	N 3		*Typha latifolia*	Pragmitetea		
HH	R 3	T 2—3	F 4	N 2—3		*Carex gracilis*	Magnocaricion		
HH	R 3—4	T 3	F 4—5	N 3	he 2	*Lycopus exaltatus*	Phragmitetea		
HH	R 3—4	T 3	F 4—5	N 3		*Mentha aqnatica*	Phragmitetalia		
H	R 3—4	T 2	F 5	N 3		*Stachys palustris*	Phragmitetea		
						Helo-hygrophyta and Hygrophyta			
H	R 0	T 0	F 3	N 2—3	hhg 3	*Agrostis stolonifera*	Agr.-Rumicion		
H	R 4—5	T 4	F 4	N 2		*Thalictrum flavum*	Molinietalia		
H	R 3	T 4	F 3—4	N 2—3	hg 1	*Leucanthemum serotinum*	Mol.-Juncetea		
H	R 3	T 3	F 4	N 3	hg 2	*Calystegia sepium*	Phragmitetea		
Th	R 3—2	T 3—4	F 3—4	N 3	hg 3	*Polygonum hydropiper*	Bidentetea		
						Hgro-mesophton			
H	R 0	T 0	F 3—5	N 0	hgm 1	*Polygonum amphibium* var. *terrestre*	Phragmitetea		

basis of its species, it can be well differentiated from the reeds of the backwaters. Character species: *Leucanthemum serotinum* (L.) STANKOV (hg 1) and in the case of weediness as a consequence of absence of permanent cutting the hg 1 *Glycyrrhiza echinata* L.

Subassociations

— phragmitetosum, typicum

Its species belong to the groups of hydato-helophytes and helophytes. In addition to the 1 *Phragmites communis,* the hhe 3 *Glyceria maxima* (HARTM.) HOLMBG and *Iris pseudacorus* L. also have a great share in cover, though some the 2-species also play a role (Table 8).

— calystegietosum sepii

It is found primarily in sections of standing waters after the clear-felling of *Populus canadensis* forest stands. Therefore, it shows transition to *Bidenti-Calystegietum* FELF. 43.

Differential species: *Calystegia sepium* (L.) R. BR (hg 2) and *Polygonum hydropiper* L. (hg 3). The latter is the member of Bidentetea. — If the stand is not mown regularly, *Glycyrrhiza echinata* L. can be also here facies-forming. Fig. 4 shows the contribution to total cover according to hydroecological categories.

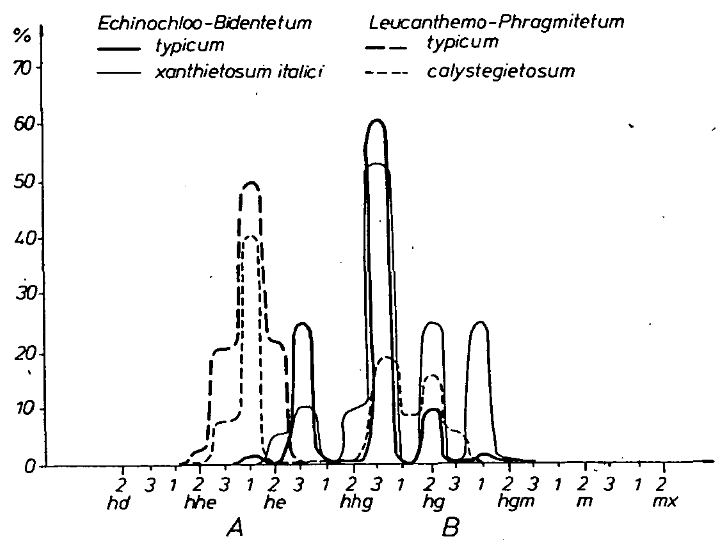


Fig. 4. Hydroecological graphs for a mud plant community (A) and a marshy meadow plant community (B).

12. *Carici gracilis-Typhoidetum arundinaceae* Soó 71

Occurrence: This community is often found in marshy habitats or where stagnant waters occur. Thus besides the flats of the flood-plain in the valley of the Tisza, similar stands were reported also from the south-west part of Slovakia (under the name of *Phalaridetum*) (BALÁTOVÁ—TULÁČKOVÁ 1968), from North-Yugoslavia (BALÁTOVÁ—TULÁČKOVÁ and KNEŽEVIC 1975), from the valley of the Danube (VICHEREK 1962).

Its stands in the Austrian section of the valley of the Danube became known on the basis of the paper by BALÁTOVÁ—TULAČKOVÁ and HÜBEL (1974).

In our landscape protection district, the stands of *Carici-Typhoidetum* do not develop in the backwaters, just like those of reeds. Mass occurrence of this association was found in deeper-lying marshy areas. In the last years, however, the flood waves recurred more than once in the vegetation period. The high stage of 2—4 m lasted for a longer period. This caused the *Typoides arundinacea* to perish from the zone at this level. Its stands were further damaged by the warming in summer of stagnant waters remaining behind, which caused the great amount of phytomass

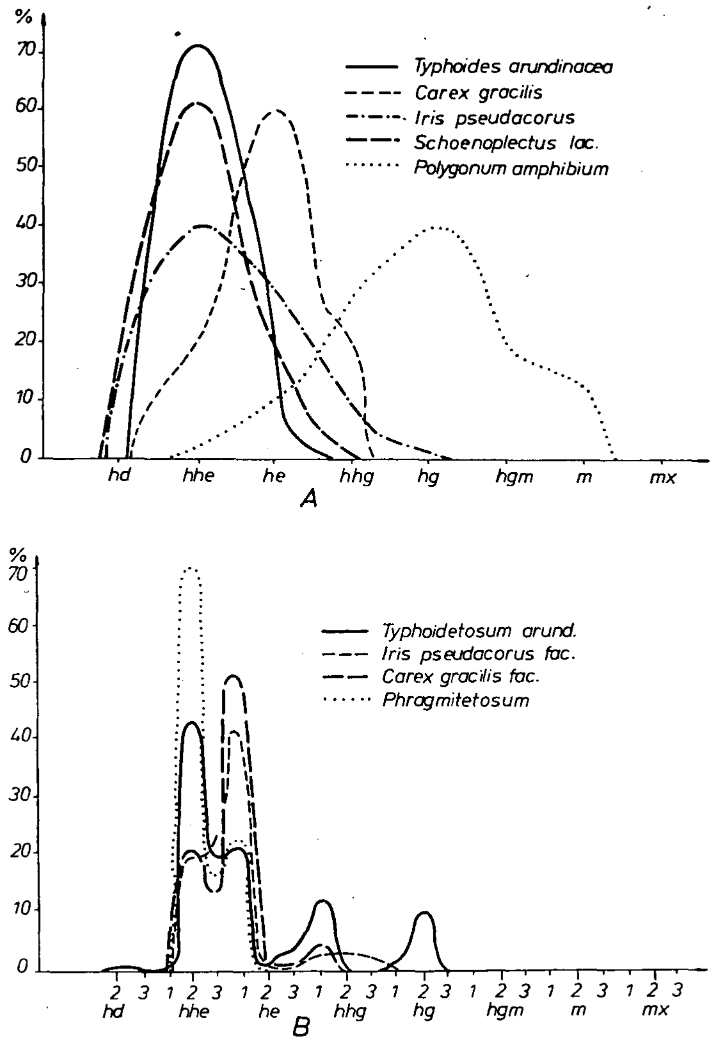


Fig. 5. Hygroecological parameters of (A) character species and (B) subunits of *Carici-Typhoidetum*-association.

Table 9. *Carici gracilis-Typhoidetum arundinaceae*

Life form	Temperature	Water demand	N-demans	Hydroecological character	Species	Character species	Phragmitetosum	Typhoidetosum	— Iris pseudacorus fac.	— Carex gracilis fac.
					Hydatophyton and Hydato-helophyta					
HH	T 2	F 4—5	N 2	hd 2	*Ranunculus trichophyllus*	Potametalia				
HH	T 0	F 3	N 3	hhe 2	*Typhoides arundinacea*	Cyperio-Sparganion				
HH	T 0	F 4—5	N 2—3		*Schoenoplectus lacustris*	Phragmition				
HH	T 3	F 5	N 3		*Butomus umbellatus*	Phragmition				
HH	T 2	F 4—5	N 3	hhe 3	*Iris pseudacorus*	Phragmitetea				
HH	T 3	F 4—5	N 3		*Glyceria maxima*	Phragmition				
HH	T 0	F 4	N 2—3		*Bolboschoenus maritimus*	Bolboschoenion				
HH	T 0	F 5	N 3		*Alisma plantago-aquatica*	Phragmitetea				
HH	T 3	F 5	N 3		*Sagittaria sagittifolia*	Phragmition				
					Helophyta					
G	T 2—3	F 4	N 2—3	he 1	*Carex gracilis*	Magnocaricion				
HH	T 0	F 0	N 2—3		*Phragmites australis*	Phtagmition				
H	T 2	F 5	N 3	he 2	*Stachys palustris*	Phragmitetea				
HH	T 2	F 3—4	N 0—3		*Lysimachia vulgaris*	Phragmitetea				
K	T 3	F 4	N 2—3		*Euphorbia lucida*	Molinion				
					Helo-hygrophyta					
H	T 2	F 4	N 2—3	hhg 1	*Lythrum salicaria*	Mol.-Juncetea				
G	T 0	F 4—5	N 2—4		*Eleocharis palustris*	Mol.-Juncetea				
G	T 3	F 4	N 3	hhg 3	*Juncus compressus*	Agrostion				
					Hygrophyta and hygro-mesophyton					
H	T 2	F 4—5	N 3—4	hg 1	*Symphytum officinale*	Molinietalia				
H	T 4	F 3—4	N 2—3		*Glycyrrhiza echinata*	Calystegion				
H	T 3	F 4	N 3	hg 2	*Calystegia sepium*	Calystegion				
H	T 3	F 3—4	N 2	hg 3	*Thalictrum lucidum*	Molinietalia				
G	T 0	F 3—5	N 0	hgm 1	*Polygonum amphibium v. terrestre*	Agr.-Rumicion				

produced to decompose under anaerobic condition. This led to hydrogen sulphide production. *Glyceria maxima* growing under similar situations proved to be more sensitive and withdrew to a higher-lying zone.

Subassociations:

— typhoidetosum arundinaceae, typicum

The contribution of the name-giving species of the hhe 3 type to cover is great; besides this species, the other members of hydatohelophytes can also attain high values of dominance. Of the helophytes the name-giving species of the association *Carex gracilis* of the he 1 type and *Lythrum salicaria* L. of the hhg 1 type can also attain high D values.

The suspension of the regular mowing of the stands results in the growth and facies-formation of *Glycyrrhiza echinata* L. and *Lythrum salicaria* L. The former has a wide hydroecological adaptability. The lasting high stage caused by floods, on the other hand was favourable for the growth of *Iris pseudacorus* and *Carex gracilis* taking the place of *Typhoides*. At the same time the number of species decreased essentially (Table 9).

CARICI (GRACILIS)-TYPHOIDETUM
LYTHRUM SALICARIA FAC.

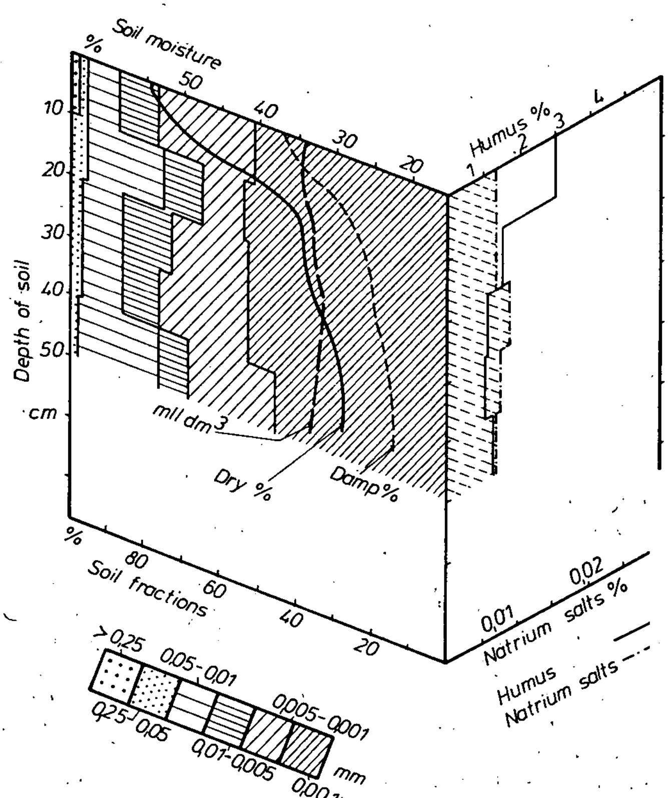


Fig. 6. Parameters for the soil ecology of *Carici-Typhoidetum* association in the autumnal aspect.

— phragmitetosum

The spread of the type hhe 2 species, primarily the gaining ground of *Phragmites* can lead to the developing of stands forming transition to marshy meadow reed stands. During the hydroecological evaluation of results — as in the case of the former stands — hydroecological graph was constructed for each species according to the method described. It is conspicuous that e.g. *Typhoides* shows one category difference relative to he 1 *Carex gracilis* CURT and that the adaptability of *Iris pseudacorus* rests on essentially broader foundations (Fig. 5-A).

The differences in moisture demand of the single subunits of association are well reflected by their different contributions to total cover within the single categories (Fig. 5-B). The colloid mass that sediments during lasting inundations impresses its character on the formation of soil in these depressions of stagnant water. The distribution of soil fractions in the soil of the river section at Körtvélyes is also in support of this (Fig. 6), since the fine clay fraction can even attain 50%, while the sand one is hardly demonstrable. The permeability to water seems to be related to that. In Fig. 6 the slope of curves plotted on the basis of moisture contents determined at the end of the vegetation period also show that. The presence of sodium salts are already demonstrable, but their amounts are still below the lowest for sodaic soils (0.01%).

13. *Caricetum gracilis* (ALM. 19, GRAEBNER et HUECK 31) TX. 37
(Syn.: Caricetum gracilis-nutantis Soó 40).

Occurrence: It is found not only in the marshes of alluvial soil of the landscape protection district of Mártély and the other sections of the valley of the Tisza, but it is known to be common in other areas in Europe as well. Because of that, its stands of similar composition were reported from the valley of the Danube in Austria (BALÁTOVÁ—TULÁČKOVÁ and HÜBEL 1974, VICHEREK 1962). Its stands described from Comitat Nógrád and other more favourable situations in Hungary (KOVÁCS 1957) contain more species. In the valley of the Tisza, due to the backwater effect of river barrages, the lower-lying flood-plains are more frequently and lastingly inundated. Thus, in the course of the last ten years, the species composition of *Caricetum gracilis* has exhibited negative changes and its spread a very positive one.
Character species: Only the hydato-helophytes which can tolerate the extreme hydrographic situation in this area survived in its stand. Thus, besides he 1 *Carex gracilis* CURT, *Lythrum salicaria* L., *Lysimachia vulgaris* L. and *Iris pseudacorus* L.

Subassociations:

— bolboschoenetosum maritimi

It has been repeatedly verified that this component conceivable as a differential species here, has some kind of property which is indicative of sodaic processes. In its soil profile in Körtvélyes, the sodium salt content amounted to 0.02% in the surfacenear level. This value is inside the lower limit for sodaic soils. Nevertheless, its damaging effect is compensated by its ample water supply. The greater accumulation of salts is prevented by the flushing effect of the regularly recurring floods.
Differential species: Besides *Bolboschoenus maritimus* (L.) PALLA the hhe 3 pseudohalophyte *Alisma lanceolatum* WITH., hhg 1 pseudohalophyte *Eleocharis palustris* (L.) R. et SCHH.

Fig. 7-A, B, illustrate the hydroecological graphs and distribution according to categories for the most important species of *Caricetum gracilis*.

— caricetosum gracilis, typicum

Its stands are dominant, and more rich in species than the previous unit. Its soil is less sodaic, usually below the lower limit of sodaic state.
Differential species: hhg 1 *Lythrum salicaria* L., hhe 3 *Iris pseudacorus* L., he 2 *Euphorbia lucida* W. et K. The latter sp. can be facies-forming in poorer stands (Table 10).

Table 10. *Caricetum gracilis*

Life form	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Bolboschoenetosum	Caricetosum gracilis	— Euphorbia lucida fac.
					Hydato-helophyta				
HH	T 0	F 3	N 3	hhe 2	*Typhoides arundinacea*	Glycerio-Sparganion			
HH	T 3	F 5	N 3		*Butomus umbellatus*	Phragmition			
HH	T 0	F 4	N 2	hhe 3	*Bolboschoenus maritimus*	Bolboschoenion			
HH	T 0	F 5	N 3		*Alisma plantago-aquatica*	Phragmitetea			
HH	T 2	F 4—5	N 3		*Iris pseudacorus*	Phragmitetea			
HH	T 0	F 5	N 3		*Alisma lanceolatum*	Phragmitetalia			
					Helophyta				
G	T 2—3	F 4	N 2—3	he 1	*Carex gracilis*	Magnocaricion			
HH	T 2	F 3—4	N 0—3	he 2	*Lysimachia vulgaris*	Phragmitetea			
H	T 3	F 4	N 2—3		*Euphorbia lucida*	Molinion			
					Helo-hygrophyta				
H	T 2	F 4	N 2—3	hhg 1	*Lythrum salicaria*	Molinio-Juncetea			
HH	T 0	F 4—5	N 2—3		*Eleocharis palustris*	Molinio-Juncetea			
H	T 3	F 4	N 2—3	hhg 3	*Lythrum virgatum*	Agrostion			
					Hygrophyton and Hygro-mesophyton				
H	T 3	F 3—4	N 2	hg 3	*Thalictrum lucidum*	Molinietalia			
G	T 0	F 3—4	N 0	hgm 1	*Polygonum amphibium* v. *terrestre*	Agr.-Rumicion			
H	T 2—3	F 3	N 3		*Alopecurus pratensis*	Mol.-Arrhenatheretea			

Concerning the hydroecological situations of the association, it can be said that while in the former subassociation the graphs for units inside hhe 2 and he 1 categories culminated at about 40%, in this type culmination occurred at he 1 and hhg 1 and remained below 30% (Fig. 7-B).

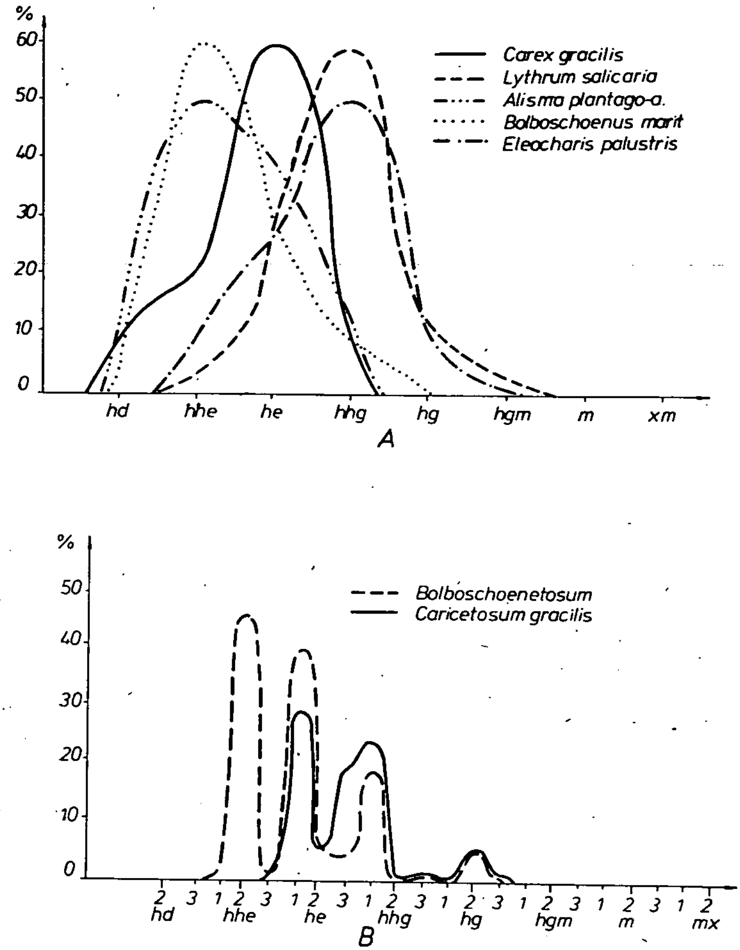


Fig. 7. Moisture demand of the species (A) and subassociations (B) of *Caricetum gracilis*-ass.

14. *Carici melanostachyae-Alopecuretum pratensis* Soó 71
(Syn.: Alopecuretum pratensis hungaricum (Now. 28) Soó 57
Agrostideto-Alopecuretum pratensis Ubr. 55)

Occurrence: It can be regarded as a transitory association among typical flood-plain marshy meadows and sedgy meadows. Its spread has increased recetnly in the landscape protection district.
Character species: The hhg 2 *Carex melanostachya* Willd., hhg 3 *Thalictrum flavum* L., hg 2 *Rorippa silvestris* L. var. *kerneri* (Menyh.) Soó, hg 2 *Euphorbia lucida* W. et K. and hg 3 *Thalictum lucidum* L. (cf. Bodrogközy and Horváth 1979).

Subassociations:

— caricetosum melanostachyae, typicum
It is the richest subgroup of association. Hydroecologically its species belong to the groups of hydato-helophytes and hygromesophytes and exhibit a wide scale of adap-

tability. The hg 1 *Carex hirta* L. has the smallest amplitude, but *Alopecurus pratensis* L. of the hgm 1 type can be regarded as a species with great adaptability. It was often found on the embankment among dominant mx species (Fig. 8-A).
With allowance to their contributions to total cover inside the hydroecological categories, the climactic points of graphs of these species occur at hhg 2 (Fig. 8-B).

— bolboschoenetosum maritimi

It is also found in the depressions of slightly sodaic alluvial soils with stagnant water cover. Its differential species is the hhe 3 stenohalophyte *Bolboschoenus maritimus* (L.) PALLA. The species number of its stands is smaller compared to the former subassociation. For their hydroecological characterization it should be mentioned that their percentual contributions to total cover culminate within the hhe 2 category (Fig. 8-B), and approximates the value of 40%.

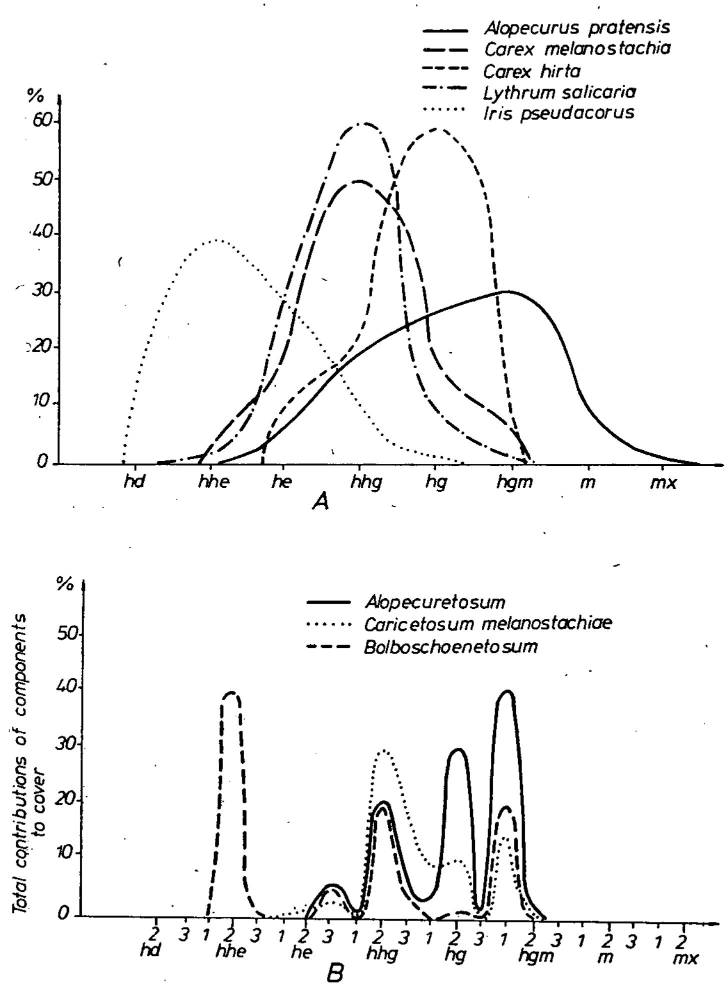


Fig. 8. Hydroecological distribution of character species (A) and subassociations (B) of foxtail meadows of transitory nature.

Table 11. *Carici melanostachyae-Alopecuretum pratensis*

Life form	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Bolboschoenetosum	Caricetosum melanostachyae	Carex gracilis facies	Alopecuretosum pratensis
					Hydato-helophyta					
HH	T 0	F 4	N 2—3	hhe 3	*Bolboschoenus maritimus*	Bolboschoenion	▬	▬	—	
HH	T 2	F 4—5	N 3		*Iris pseudacorus*	Phragmitetea	▬	▬	—	▬
					Helophyta					
G	T 2—3	F 4	N 2—3	he 1	*Carex gracilis*	Magnocaricion	—	—	▬	
H	T 3	F 4	N 2—3	he 2	*Euphorbia lucida*	Molinion	—	—	—	
HH	T 2	F 3—4	N 0—3		*Lysimachia vulgaris*	Phragmitetea	—	—	—	—
H	T 3	F 4—5	N 3		*Mentha aquatica*	Phragmitetalia		—	▬	
H	T 2	F 5	N 3		*Stachys palustris*	Phragmitetea		—		
					Helo-hygrophyta					
H	T 2	F 4	N 2—3	hhg 1	*Lythrum salicaria*	Molinio-Juncetea	▬	▬	—	▬
HH	T 0	F 4—5	N 2—3	hhg 1	*Eleocharis palustris*	Molinio-Juncetea		—	▬	—
HH	T 3	F 4	N 2	hhg 2	*Carex melanostachya*	Magnocaricion	▬	▬	▬	▬
H	T 0	F 3	N 2—3	hhg 3	*Agrostis stolonifera*	Agr.-Rumicion		▬		▬
H	T 4	F 4	N 2		*Thalictum flavum*	Molinietalia	—	—	—	
G	T 3	F 4	N 3		*Juncus compressus*	Agrostion		—		
					Hygrophyta					
H	T 4	F 3—4	N 2—3	hg 1	*Glycyrrhiza echinata*	Calystegion	—	—		▬
G	T 2—3	F 3—4	N 3		*Carex hirta*	Agr.-Rumicion		▬		▬
H	T 4	F 3—4	N 2—3		*Leucanthemum serotinum*	Molinio-Juncetea		▬		▬
H	T 1	F 4—5	N 2—3	hg 2	*Ranunculus repens*	Agr.-Rumicion		—		▬
Th	T 0	F 3	N 3—4		*Echinochloa crus-galli*	Chenopodietea		—	▬	
H	T 3	F 4	N 3		*Calystegia sepium*	Calystegion	—	—		—
H	T 4	F 3	N 2		*Rorippa silvestris* v. kerneri	Agr.-Rumicion		—		—
H	T 2	F 3—4	N 3—4	hg 3	*Poa trivialis*	Mol.-Arrhenatheretea		—		
H	T 3	F 3—4	N 2		*Thalictrum lucidum*	Molinietalia	—	—		—
					Meso-hygrophyta					
H	T 2—3	F 3	N 3	hgm 1	*Alopecurus pratensis*	Mol.-Arrhenatheretea	▬	▬	▬	▬
H	T 3—4	F 4—5	N 3		*Rorippa austriaca*	Agr.-Rumicion				—

— alopecuretosum pratensis

It occurs in the marshy meadows of Körtvélyes holm covered with standing water for longer or shorter períods. Here *Alopecurus* becomes more competitive. Thus principally the hygrophytes prevail. Its differential species are: hg 1 *Glycyrrhiza echinata* L., *Carex hirta* L. and hg 2 *Ranunculus repens* L., *Leucanthemum serotinum* (L.) STANKOV also occurs here. During the summer, when floods recurrently occur and inundation is more lasting, the type he 1 *Carex gracilis* CURT. can be facies-forming (Table 11).

With regard to the places of its components inside the hydroecological categories and on the basis of their percentual contributions to total cover the climactic point obtained shows a gradually increasing tendency in the direction of hgm (Fig. 8-B).

The report on studies performed between 1974 and 1977 in connection with the seasonal changes of its phytomass production according to species was published earlier (BODROGKÖZY and HORVÁTH 1979).

In addition to the height and lastingness of the water cover, the situation of the underground water level can also influence the seasonal changes of species composition of marshy and marshy meadow communities, as has been verified earlier by BALÁTOVÁ—TULAČKOVÁ (1965, 1968). In our area, however, the ground water has never risen above soil surface, because the extremely high colloid content of soil prevents surface waters from seeping into the soil. Soil profile analyses performed in a period of lasting water cover by means of pipe-liner verified that.

15. *Lythro virgatae-Alopecuretum pratensis* BODRK. 77
(Syn.: Alopecuretum pratensis hung. normale
Agrostideto-Alopecuretum pratensis UBR. 55)
Alopecuretum pratensis normale BODRK. 62)

Occurrence: It was the most frequent marshy meadow community in the middle and upper sections of the flood-plain in the valley of the Tisza before the construction of the river barrages and power stations (BODROGKÖZY 1962). The frequent floodings occurring as a consequence of these impoundings have caused this community to suffer ever increasing damages. Thus, in our area, too, it was gradually transformed into *Carici gracilis-Alopecuretum,* moreover in some places *Caricetum gracilis* during the last 10 years. On the other hand, *Typhoides* became immigrant species in this zone and more than once facies-forming element. Thus, the richly coloured hayfilds of foxtail type have also disappeared from a large part of the district. The same could be observed earlier in the region of Tokaj at Bodrogzug.
Character species: *Lythrum virgatum* L. of the hh 3 type, hg 1 *Symphytum officinale* L., hg 3 *Poa trivialis* L. and hgm 3 *Mentha arvensis* L.

Subassociations:

— alopecuretosum pratensis, typicum

Differential species: he 2 *Lysimachia vulgaris* L., hg 1 *Gratiola officinalis* L. and hg 3 *Poa trivialis* L.

It is characteristic of the situations in its habitat that after the retirement of the flood of shorter duration and smaller extent less colloid settles down. Thus the permeability to water of the silty alluvial soil is more favourable and the stagnant waters left behind will not produce harmful effect.

This explains the much greater species number in this community relative to

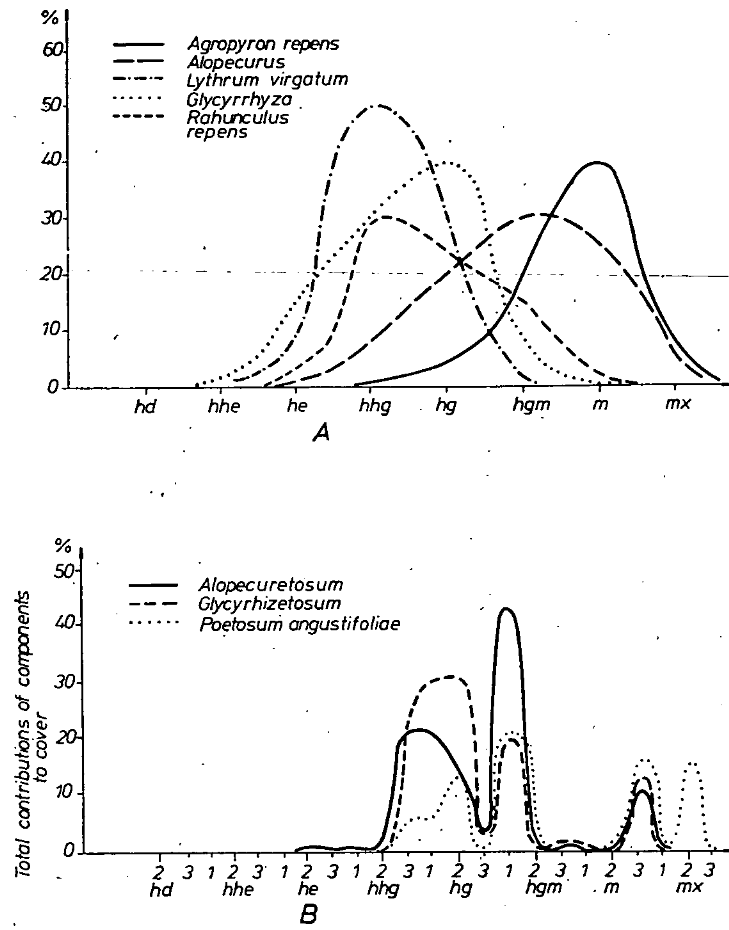


Fig. 9. Hydroecological conditions of typical foxtail meadows (A, B).

that of the previous association. Moreover, the hydrocenological adaptability of these components is also much wider (Fig. 9-A).

The hydroecological plots drawn on the basis of the contributions of these species to total cover exhibit two culminations, but the values of these is not higher than 20%; namely, in the case of hg 3 and hgm 1 subgroups (Fig. 9-B).

— glycyrrhizetosum echinatae

Differential species is hg 1 *Glycyrrhiza echinata* L. It is found generally in such situations when the yield of the hayfields is of sour hay nature, and therefore their regular mowing and the gathering of hay is no more economical. *Carex melanostachya* WILLD. is facies-forming, *Lythrum virgatum* L., occasionally *L. salicaria* L. increase and the community assumes lilac colour in the late aestival aspect. In the lower herb stratum, *Potentilla reptans* L. (hg 2) exhibits a high D value (Table 12).

— poetosum angustifoliae

(Syn.: Alopecuretum pratensis poetosum angustifoliae)

Table 12. *Lythro virgatae-Alopecuretum pratensis*

Life form	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Alopecuretosum	Potentilla reptans fac.	Glycyrrhizetosum	Poëtosum angustifoliae
					Helophyta					
H	T 3	F 4—5	N 3	he 2	*Mentha aquatica*	Phragmitetalia	—			
HH	T 2	F 3—4	N 0—3		*Lysimachia vulgaris*	Phragmitetea	—			
					Helo-hygrophyta					
H	T 2	F 4	N 2—3	hhg 1	*Lythrum salicaria*	Molinio-Juncetea	—	▬		
H	T 3	F 4	N 2—3	hhg 3	*Lythrum virgatum*	Agrostion	█	▬	█	▬
H	T 4	F 4	N 2		*Thalictum flavum*	Molinietalia	▬	▬	▬	—
H	T 0	F 3	N 2—3		*Agrostis stolonifera*	Agr.-Rumicion	—	—	—	
					Hygrophyta					
H	T 4	F 3—4	N 2—3	hg 1	*Glycyrrhiza echinata*	Calystegion	█	—	█	█
H	T 2	F 4—5	N 3—4		*Symphytum officinale*	Molinietalia	▬	█	█	
H	T 4	F 3—4	N 2—3		*Leucanthemum serotinum*	Molinio-Juncetea	—		▬	—
H	T 2	F 4	N 2		*Gratiola officinalis*	Molinion	—			
H	T 3	F 3—4	N 2—3	hg 2	*Potentilla reptans*	Agr.-Rumicion	▬	█	█	▬
H	T 1	F 4—5	N 2—3		*Ranunculus repens*	Agr.-Rumicion	▬	█	█	▬
H	T 3	F 4	N 2—3		*Euphorbia lucida*	Molinion	▬	▬	▬	—
H	T 2	F 3—4	N 3—4	hg 3	*Poa trivialis*	Mol.-Arrhenatheretea	▬	—		
					Hygro-mesophyta					
H	T 2—3	F 3	N 3	hgm 1	*Alopecurus pratensis*	Mol.-Arrhenatheretea	█	█	█	█
H	T 1	F 2—3	N 0		*Vicia cracca*	Mol.-Arrhenatheretea	▬	▬	▬	—
H	T 0	F 3—4	N 3—4		*Mentha arvensis*	Molinietalia	—		—	—
					Mesophyta					
Th	T 3—4	F 3	N 3—4	m 2	*Setaria lutescens*	Agr.-Rumicion	—	—		—
G	T 0	F 2—3	N 3—4	m 3	*Agropyron repens*	Agr.-Rumicion	█	▬	█	█
Th	T 3	F 0	N 3		*Vicia tetrasperma*	Secalietea	—		—	—
					Meso-xerophyta					
H	T 2	F 2	N 3	mx 2	*Poa angustifolia*	Festuco-Brometea	—		▬	█
G	T 3	F 2—3	N 2		*Carex praecox*	Festuco-Brometea				▬
H	T 0	F 3	N 2—3		*Plantago lanceolata*	Agr.-Rumicion				—

It could be observed in those years when the floods did not occur, or lasted for a shorter period, and this zone of the flood-plain was not flooded for a longer time. It exhibited transition to *Poo angustifoliae-Alopecuretum* covering a dryer marshy meadow zone.

Its differential species are mx 2 *Carex praecox* SCHREB. and mx 3 *Poa angustifolia* L. with wide hydroecological adaptability.

16. *Poo angustifoliae-Alopecuretum pratensis* BODRK. 62
(Syn.: Alopecuretum pratensis hung. poetosum angustifoliae)

In the flood-plains of greater elevation in the valley of the Tisza, the drying foxtail marshy meadows are getting gradually eclipsed. In our landscape protection district it occurs only sporadically. In other places, for a more favourable nutrient supply and less lasting water cover, it forms more rich and richly coloured stands (BODROGKÖZY 1961, 1962). Compared with its other stands in our country, the foxtail meadows of Transdanubia and the plain in Northwestern Hungary, named "Kis Alföld" seems to be related with the association in respect to the number of species; thus, the meadows in Comitat Baranya (HORVÁTH 1960), the hayfields along the river Rába (JEANPLONG 1960) or those in the plain "Kis Alföld" in Northwestern Hungary (BORHIDI 1956) and in the eastern part of the Great Hungarian Plain (SIMON 1960). From the eulittoral — epilittoral zone of the valley of the Danube, VICHEREK (1962) described similar stands. They are known from the northern part of the central range of mountains on the basis of investigations and reports by MÁTHÉ (1956) and MÁTHÉ—KOVÁCS (1960). In our area it has fallen victim principally to the increased cultivation of hoed plants.

17. *Digitario-Portulacetum oleraceae* (FELF. 42) TIM. et BODRK. 55

Development: It occurs in the most elevated areas on the terrace-like arranged dunes by the Tisza in the landscape protection district of Mártély. This elevated zone is seldom or never flooded. Because of that, it is suitable also for the cultivation of hoed plants. For this reason the original *Cynodonto-Poëtum angustifoliae* (RAPCS. 26) SOÓ 57 pastures were broken up and utilized mainly as maize-field. The regular cultivation on loose alluvial-type sandy soil favours the development of *Digitario-Portulacetum*.

On the basis of its species composition, this association is similar to the weed communities reported from hoed plant cultures in the area between the Danube and the Tisza. Its character species are: mx 3 *Portulaca oleracea* L., m 3 *Digitaria sanguinalis* (L.) SCOP., m 3 *Agropyron repens* P. B. as well as mx 3 *Ambrosia elatior* L. greatly spreading in our area.

Ecological conditions of soil: Soil profile analyses showed the physical clay fraction to constitute only in the upper layers 20% of the soil. The fine sand fraction predominates. The moisture supply of soil is small in the autumnal aspect. The organic matter content is similarly low. The calcium carbonate content, however, can increase to 3—4% which is not frequent in the valley of the Tisza (Fig. 10).

18. *Agropyro-Convolvuletum arvensis* FELF. 43
(Syn.: Agropyretum repentis FELF. 42).

Development: It also formed on the more elevated sand dunes after the great flood in 1970, where fruit gardens had flourished for about a century. As a consequenc of lasting floods of high water stage, all fruit and grape species perished except the

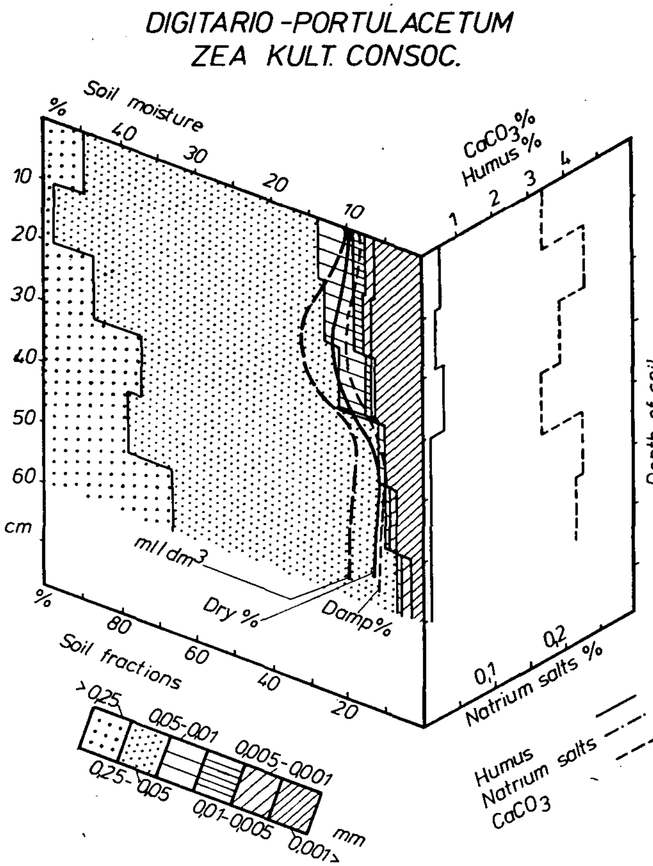


Fig. 10. Soil ecological parameters of the weed ocmmuni tiesof hoed plant cultures on sanldy soil.

pear one. This weed community which is the variety of *Agropyro-Convolvuletum agropyretosum* and calamagrostidetosum developed on this soil left in its greatest part uncultivated. The original community must have also been *Cynodonto-Poëtum angustifoliae.*Today it is agropyretosum, typicum.

In the lower parts among the dunes, however, the original vegetation must have been *Poo angustifoliae-Alopecuretum pratensis* for the more favourable water supply. Today the variety *Agropyro-Convolvuletum rubetosum caesii* is common here. Its soil is essentially harder than that of the type, because of its high fine clay (0.001 mm fraction) content. Towards deeper layers, however, the amount of this fraction diminishes. This is obviously due to the sedimentation of silt-clay caused by the changed water course after the construction of the protecting dam system along the Tisza. The accumulation of sodium salts is already demonstrable here (Fig. 11).

— rubetosum caesii

Differential species: *Rannunculus repens* L., *Glechoma hederacea* L. of the hg 2 type each, hgm 1 *Xanthium italicum* Moretti. *Amorpha fruticosa* L. and *Fraxinus pennsylvanica* Marsh often forming impenetrable thickets can be facies-forming in both subassociations.

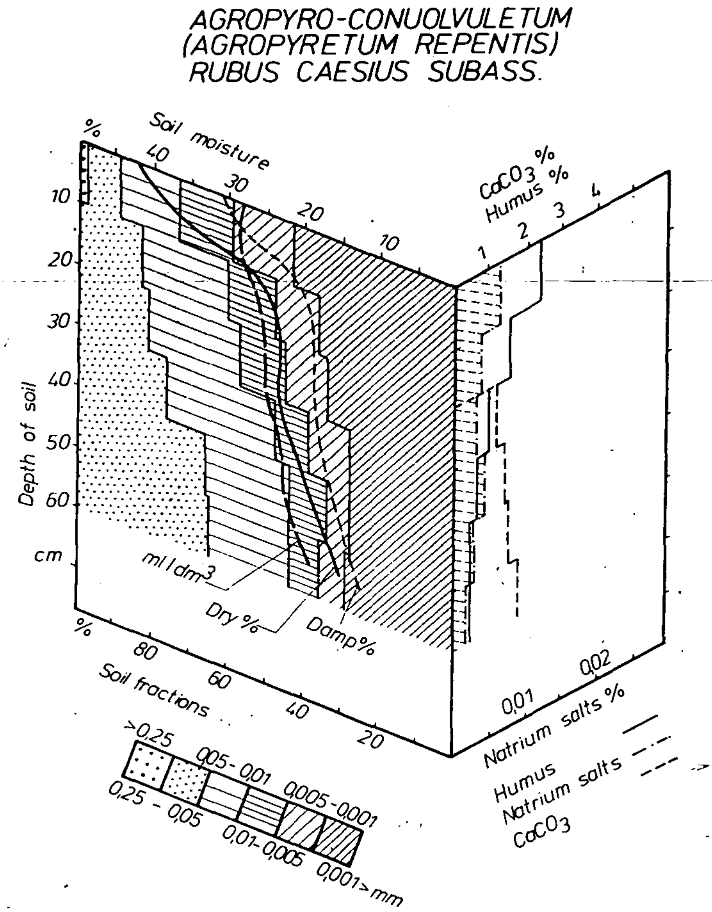


Fig. 11. Physical and chemical parameters of the soil of a weed community dominated by couch.

19. *Bidenti-Calystegietum sepii* FELF. 43

Development: During the last 30 years large tracts of the landscape protection district were planted with Canadian poplar. In the place of the wood stands felled in cutting age so called cutting vegetation has developed and occupied increasingly greater areas in the district. Their characteristic stands develop within a few years. Character species: hg 2 *Calystegia sepium* (L.) R. BR., hg 3 *Polygonum hydropiper* L., hg 1 *Carex hirta* L., hgm 3 *Aristolochia clematitis* L., hg 3 *Poa trivialis* L. and hhg 3 *Myosoton aquaticum* (L.) MÖNCH.

For the appearance of differential species characteristic of the changed hydrographical situation, the following subassotiations could be differentiated:

— calystegietosum sepii, typicum

It can be expected to occur in medium moist habitats, often together with the *Amorpha fruticosa* facies.

— caricetosum gracilis

Forms stands in marshy habitats at lower-lying places. Differential species are *Carex gracilis* CURTIS, *Iris pseudacorus* L. and *Echinochloa crus-galli* (L.) P. B., occasionally *Stachys palustris* L., too.

20. *Echionochloo-Bidentetum tripartitae* (W. KOCH 26) SOÓ 71.
(Syn.: Bidentetum tripartiti (W. KOCH 26) LIBBERT 32
Polygonum hydropiper-Bidens tripartitus ass. LOHM. 50)

Occurrence: It is the mud weed community in the clay-pits, earth mines of the embankments along the rivers. During the last 60—80 years, these pits have been filled in such a degree that now they contain water only for a very short time. Thus they are favourable habitats for Bidention stands. Similar associations were reported also from the other sections of the Tisza valley (TIMÁR 1950). The Bidention mud-plant societies in Croatia became known on the basis of MARKOVIC's investigations (1975). It was reported on from West Europe by LOHMEYER (1950) and in European relations by POLI and TÜXEN (1960).
Character species: *Bidens tripartita* L. and *Polygonum minus* HUDS. of the hhg 3 type each; hg 3 *P. mite* SCHRANK, hhg 3 *Myosoton aquaticum* (L.) MÖNCH. and the similar *Rorippa palustris* (L.) BESS.

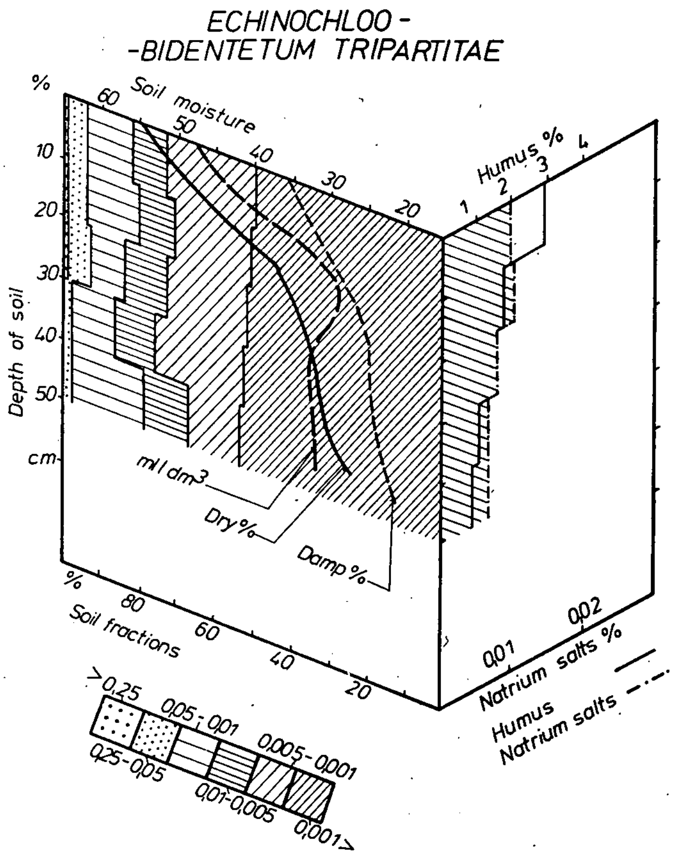


Fig. 12. Physical and chemical conditions of the soil of weed community on muddy alluvial soil in the littoral.

Subassociations:

— bidentetosum, typicum

One of the most frequent mud-plant weed cenoses of the valley of the Tisza. Though it is principally composed of helo-hygrophytes, single individuals of hhe 3 *Glyceria maxima* (HARTM.) HOLMG., he 1 *Oenanthe aquatica* (L.) Poir. and he 3 *Potentilla supina* L. forming the lower herb stratum also occur here. The latter can be facies-forming.

— xanthietosum italici

It develops in pits on soils somewhat dryer than the former ones, i.e. in places not flooded before and in other similar devastated places. Differential species are: hg 3 *Polygonum mite* SCHRANK, hg 2 *Echinochloa crus-galli* (L.) P. B., but chiefly hgm 1 *Xanthium italicum* MORETTI forming large stands (Table 13).

Soil ecology: There is plenty of time for the colloids to settle in the stagnant waters. Thus the soil is very hard: the physical clay fraction can amount to 80% and in it the fine clay component dominates.

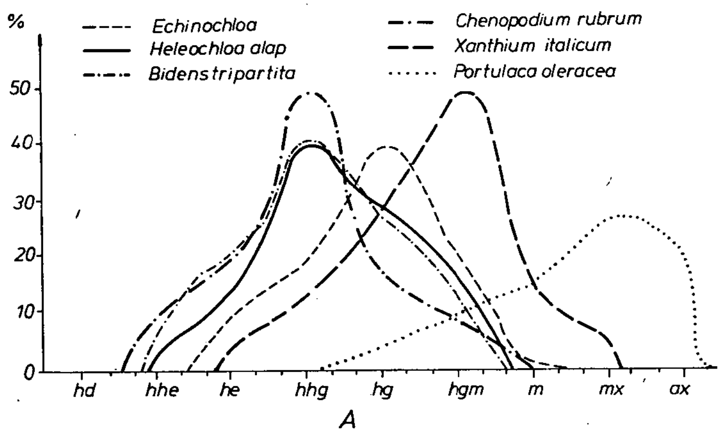
Since the soil is less permeable to water, the water cover lasts longer and the lower soil layers are moisted in a lesser degree (Fig. 12). Accumulation of sodium salts is also considerable, though these are not harmful in diluted state.

Table 13. *Echinochloo-Bidentetum tripartiti*

Life form	Acidity of soil	Temperature	Water demand	N-demans	Hydroecological character	Species	Character species	Bidentetosum	Xanthietoum italici
						Hydato-helophyta and Helophyta			
HH	R 3—4	T 3	F 4—5	N 3	hhe 3	*Glyceria maxima*	Phragmition		
HH	R 0	T 3	F 5	N 2	he 1	*Oenanthe aquqtica*	Phragmitetalia		
HH	R 3—4	T 3	F 4—5	N 2—3	he 2	*Rorippa amphibia*	Phragmitetea		
Th	R 2—3	T 3	F 5	N 2—3	he 3	*Potentilla supina*	Nanocyperion		
						Helo-hygrophyta			
Th	R 0	T 0	F 3	N 3—4	hhg 2	*Chenopodium rubrum*	Bidentetea		
Th	R 0	T 3	F 3—4	N 3—4	hhg 3	*Bidens tripartita*	Nanocyperion		
Th	R 2—3	T 0	F 4—5	N 3		*Rorippa palustris*	Bidentetea		
Th	R 2—3	T 3	F 3—4	N 2—3		*Polygonum minus*	Bidention		
Th	R 0	T 2	F 3	N 3—4		*Myosoton aquatica*	Calystegion		
						Hygrophyta and Hygro-mesophyta			
Th	R 0	T 0	F 3	N 3—4	hg 2	*Echinochloa crus-galli*	Chenopodietea		
Th	R 0	T 3	F 3	N 3	hg 3	*Polygonum mite*	Bidentetea		
Th	R 0	T 3—4	F 3	N 2—3	hgm 1	*Xanthium italicum*	Bidentetea		

21. *Echinochloo-Heleochloetum alopecuroidis* (n. nov)
(non Cyperio-Spergularion: Heleochloetum alopecuroidis (RAPCS 27) UBR. 48).

Occurrence: When the flood- plain of the Tisza and thus the higherlying parts of the agricultural tillages of the landscape protection district are lastingly flooded during the summer, the cultivated plants perish. In their place mud vegetation growing on loose soil and content with shorter vegetation period appears. Concerning its species it can be easily differentiated from the former association.
Character species: They have a wide hydroecological adaptability. In the place of the original *Digitario-Portulacetum Zea* culture consociation principally the hygrophytes grow. Thus, besides the name-giving species and in addition to hhg 2 *Potentilla anserina* L. the hg 2 *Calystegia sepium* (L.) R. BR; moreover, some mesophytes can also thrive there as hgm 3 *Plantago major* L. and even mx 3 *Portulaca oleracea* L. of wide adaptability (Fig. 13-A).



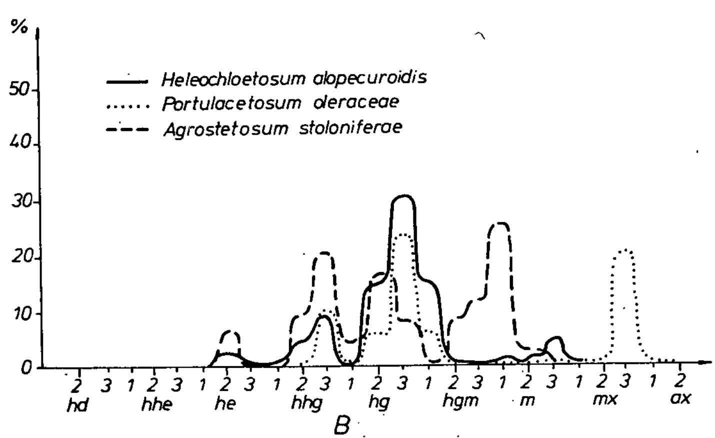


Fig. 13. Hydroecological conditions of the species (A) and stands (B) of the association of *Heleochloa alopecuroides.*

Subassociations:

— heleochloetosum alopecuroidis, typicum

It occupies the lower-lying zone of flatter sand dunes located in terrace-like pattern and covered with water for the longest time. Its species number is low. Differential species are hhe 3 pseudohalophyte-type *Alisma lanceolatum* WITH. and he 2 *Lycopus exaltatus* L.

— agrostetosum stoloniferae

It the lasting water cover in summer recurs for more than one year, several hemikrypophytes will join the society. For the suspension of the devastaging agrotechnical effects, species number increases.

Differential species: hhg 3 *Agrostis stolonifera* L., hhg 3 *Rorippa sylvestris* (L.) BESS, hg 2 *Calystegia sepium* (L.) R. BR., hgm 3 *Polygonum lapathifolium* L. and hhg 2 *Chenopodium rubrum* L.

— portulacetosum oleraceae

It is found in elevated places of flat sand dunes where the water cover lasts for a shorter period. Thus among its differential species mx 3 *Portulaca oleracea* L. as the character species of the original *Digitario-Portulacetum,* where its share is highly dominant, can occur in great quantities. Besides mx 1 *Polygonum aviculare* L. is also found here (see further details in Table 14).

The hydroecological plots of the single subunits of association illustrate their water demand, and the degree of their adaptabilities (Fig. 13-B).

22. *Echinochloo-Polygonetum lapathifolii* (UJV. 40) SOÓ et CSÜRÖS (40) 47.
(Syn.: Polygonum lapathifolium ass. UJV. 40, Juncéto-Polygonetum SOÓ 43)

Occurrence: The areas covered by *Lythro-Alopecuretum,* but much rather by *Poo-Alopecuretum* below the dunes peris if the area is ploughed up and permantly covered with water in the interest of hoed plant cultures. In their place the mud vegetation of hard alluvial soils appears. It often forms only clearings among the maize-fields.

Character species: hgm 3 *Polygonum lapathifolium* L., hg 1 type *Symphytum officinale* S., m 2 *Setaria lutescens* (WEIGEL) HUBBARD and hgm 1 *Rubus caesius* L.

Subassociations:

— echinochloetosum

In the most damp depressions of cultivated soil if forms luxuriant stands.

Differential species are *Echinochloa crus-galli* (L.) P. B. and *Bidens tripartita* L.

— polygonetosum lapathifolii, typicum

Occurs on tillages less covered with stagnant waters.

Differential species besides the name-giving one are: hgm 1 *Xanthium italicum* MORETTI, *Setaria lutescens* (WEIG.) HUB. and hgm 3 *Aristolochia clematitis* L.

The texture of soil in this subassociation is similar to that of *Poo angustifoliae-Alopecuretum.* 80% of the decantable part of soil consists of equal amounts of coarse silt (0.05—0.01 mm) and fine colloidal clay fraction (0.001 mm). The amount of sodium salts bounded to this adsorbtion complex approximates the lower limit of sodaic condition (0.01%). This is, however, not evident yet from the species composition of the community (Fig. 14).

23. *Lolio-Alopecuretum pratensis* BODRK. 62

Occurrence: It is found everywhere in the foxtail meadows under grazing. In the "Barci-rét" of our landscape protection district it has developed principally by the

Table 14. *Echinochloo-Heleochloetum alopecuroidis*

Life form	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Agrostetosum	Heleochloetosum alopecuroidis	Portulacetosum
					Hydato-helophyton and Helophyta				
HH	T 0	F 5	N 3	hhe 3	*Alisma lanceolatum*	Phragmitetalia	—		
H	T 2	F 5	N 3	he 2	*Stachys palustris*	Phragmitetea	—		
HH	T 3	F 4—5	N 3		*Lycopus exaltatus*	Phragmitetea	—		
HH	T 2	F 3—4	N 0—3		*Lysimachia vulgaris*	Phragmitetea		—	
					Helo-hygrophyta				
Th	T 0	F 3	N 3—4	hhg 2	*Chenopodium rubrum*	Bidentetea	■		
H	T 1	F 4—5	N 4—5		*Potentilla anserina*	Agr.-Rumicion	■		
H	T 4	F 3	N 2	hhg 3	*Rorippa sylvestris*	Agr.-Rumicion	■	—	—
Th	T 3	F 3—4	N 3—4		*Bidens tripartita*	Bidentetea		■	■
H	T 0	F 3	N 2—3		*Agrostis stolonifera*	Agr.-Rumicion	■		
Th	T 0	F 2—4	N 1		*Heleochloa alopecuroides*	Cyperio-Spergularion	■	■	■
					Hygrophyta				
H	T 4	F 3—4	N 2—3	hg 1	*Glycyrrhiza echinata*	Calystegion	■		
Th	T 0	F 3	N 3—4	hg 2	*Echinochloa crus-galli*	Chenopodietea	■	■	—
H	T 3	F 4	N 3		*Calystegia sepium*	Calystegion	■		
					Hygro-mesophyta				
Th	T 3—4	F 3	N 3—4	hgm 1	*Xanthium italicum*	Bidentetea	—	■	—
H	T 0	F 3—4	N 3—4		*Mentha arvensis*	Molinietalia	—		
H	T 0	F 2—3	N 3	hgm 3	*Plantago major*	Plantaginetea	■	—	
Th	T 0	F 3—4	N 3—4		*Polygonum lapathifolium*	Pol.-Chenopodion	■		
G	T 4	F 3	N 3		*Aristolochia clematitis*	Calystegion	—		
H	T 0	F 2—3	N 2—3		*Rumex crispus*	Agr.-Rumicion	—		
G	T 2	F 3—4	N 3—4		*Equisetum arvense*	Secalietea	—		
H	T 0	F 2—3	N 2		*Glechoma hederacea*	Mol.-Arrthenatheretea	—		
					Mesophyta				
Th	T 0	F 2—3	N 3	m 1	*Sonchus asper*	Pol.-Chenopodion			—
Th	T 3—4	F 3	N 3—4	m 2	*Setaria lutescens*	Pol.-Chenopodietalia		—	—
Th	T 3—4	F 3	N 4		*Malva neglecta*	Polygonion	—		
G	T 3	F 0	N 3		*Convolvulus arvensis*	Chen.-Scleranthea	—		
Th	T 3	F 2—3	N 4—5		*Amaranthus retroflexus*	Chenopodietea	—		
Th	T 0	F 0	N 4—5		*Chenopodium album*	Chenop.-Scleranthea	—		
					Meso-xerophyta				
H	T 0	F 3	N 2—3	mx 1	*Polygonum aviculare*	Chen.-Scleranthea			■
Th	T 0	F 2	N 3—4	mx 3	*Portulaca oleracea*	Pol.-Chenopodietalia			■

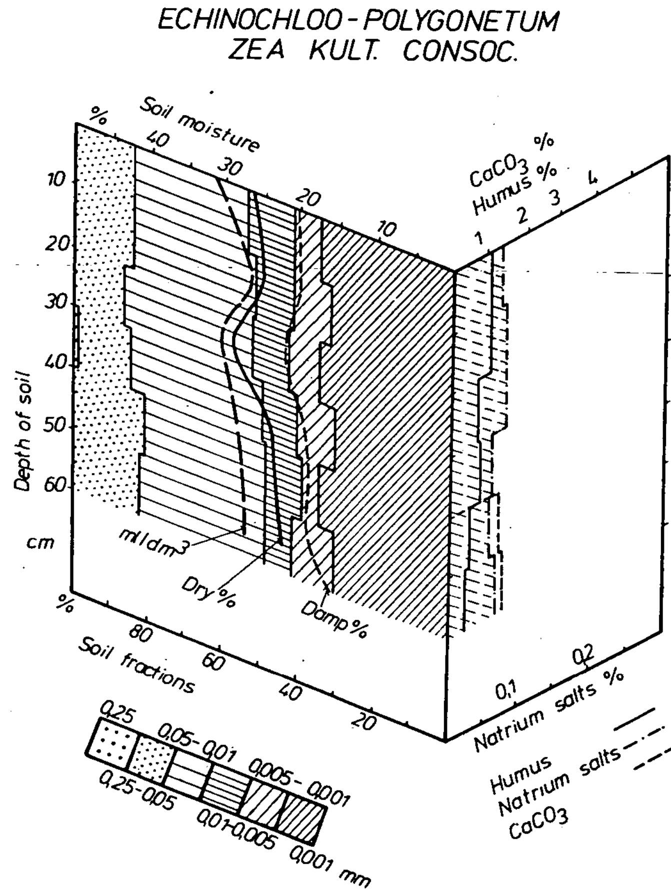


Fig. 14. Parameters of the soil of *Echinochloo-Polygonetum*-association.

transformation of the original *Lythro virgatae-Alopecuretum* which was caused by regular grazing.
Its species composition is nearly identical with those reported from other pastures in the valley of the Tisza (BODROGKÖZY 1962).

References

AMBROZ, Z. und BALÁTOVÁ-TULÁČKOVÁ, E. (1968): Zur Kenntnis der biologischen Aktivität und des Humusanteils in den Böden der Magnocaricetalia- und Molinietalia-Gesellschaft im Gebiet der SW-Slowakei. — Preslia *40,* 80—93.

BALÁTOVÁ-TULAČKOVÁ, E. (1965): Die Sumpf- und Wiesengesellschaften der Mineralböden südlich des Zábřeh bei Hlučin. — Veget. Acta Geobot. *13,* 1—51.

BALÁTOVÁ-TULÁČKOVÁ, E. (1968): Grundwasserganglinien und Wiesengesellschaften (Vergleichende Studie der Wiesen aus Südmähren und der Südwestslowakei). — Acta Sci. Nat. Acad. Sci. Boh.-slov. *2,* 1—37.

BALÁTOVÁ-TULÁČKOVÁ, E. und HÜBL, E. (1974): Über die Phragmitetea und Molinietalia-Gesellschaften in der Thaya-, March- und Donau-Aue Österreichs. — Phytocoen. Stuttgart *1,* 263—305.

BALÁTOVÁ-TULÁČKOVÁ, E. und KNEŽEVIČ, M. (1975): Beitrag zur Kenntnis der Überschwemmungswiesen in der Drava- und Karašica-Aue (Nord-Jugoslawien). — Acta Bot. Croat. *34*, 63—80.

BODROGKÖZY, GY. (1958): Beiträge zur Kenntnis der synökologischen Verhältnisse der Schlammvegetation auf Kultur- und Halbkultur Sandbodengebieten. — Acta Biol. Szeged *4*, 121—142.

BODROGKÖZY, GY. (1961): Ökologische Untersuchungen der Mähwiesen und Weiden der Mittel-Theiss (Das Leben der Tisza XIII). — Phyton (Graz) *9*, 196—216.

BODROGKÖZY, GY. (1962): Das Leben der Tisza XVIII. Die Vegetation des Theiss-Wellenraumes. I. Zönologische und ökologische Untersuchungen in der Gegend von Tokaj. — Acta Biol. Szeged *8*, 3—44.

BODROGKÖZY, GY. (1965): Die Vegetation des Theiss-Wellenraumes. II. Vegetationsanalyse und Standortökologie des Wasser- und Sumpfpflanzenzönosen im Raum von Tiszafüred. — Tiscia (Szeged) *1*, 5—31.

BODROGKÖZY, GY. (1967): Vegetation of the Tisza inundation area. IV. Examination result of the Magnocaricion associations from the area Alpár. — Tiscia (Szeged *3*, 27—40.

BODROGKÖZY, GY. and HORVÁTH, I. (1977): Connection between stand pattern and the organic-matter production in the marshlands of the inundation area at Körtvélyes. — Tiscia (Szeged) *12*, 65—70.

BODROGKÖZY, GY. and HORVÁTH, I. (1979): Effect of lasting floods on the species composition and organic-matter production of the marshy meadow-lands in the floodplains of the Tisza — Tiscia (Szeged) *14*, 81—88.

BORHIDI, A. (1956): Die Steppen und Wiesen im Sandgebiet der Kleinen Ungarischen Tiefebene. — Acta Bot. Acad. Sci. Hung. *2*.

ELLENBERG, H. (1952): Wiesen und Weiden und ihre standörtliche Bewertung. — Stuttgart.

ESKUCHE, U. (1963): Untersuchunge des Bodenwasserhaushaltes von Pflanzengesellschaften. — Dt. Gewässerkundl. Mitt. 17—20.

FINTA, I. (1979): Revision of the home Distribution of Wolffia arrhiza L. — Tiscia (Szeged) *14*, 71—80.

GÖRS, S. (1968): Der Wandel der Vegetation im Naturschutzgebiet Schenniger Moos unter dem Einfluss des Menschen in zwei Jahrhunderten. Aus "Das Schwenninger Moos". — Die Nat. u. Landsch. Baden—Würtembergs *5*, 190—284.

JEANPLONG, J. (1960): Vázlatok a Rába határvidék ártereinek rétjeiről (Übersichtliche Schilderung der am oberen Raab-lauf in Ungarn gelegenen Wiesen). — Bot. Közlem. *48*, 289—299.

HEJNÝ, S. (1960): Ökologische Charakteristik der Wasser- und Sumppflanzen in der slowakischen Tiefebenen (Donau- und Theissgebiet). — Bratislava.

HORVÁTH, A. O. (1960): Mecsek környéki rétek (Die Wiesen der Mecsekgegend). — Janus Pannonius Mus. Évk. 53—67.

KÁRPÁTI, V. (1963): Die zönologischen und ökologischen Verhältnisse der Wasservegetation des Donau-überschwemmungsraumes in Ungarn. — Acta Bot. Acad. Sci. Hung. *9*, 323—384.

KNAPP, R. und STOFFERS, A. L. (1962): Über die Vegetation von Gewässern und Ufern in mittleren Hessen und Untersuchungen über den Einfluss von Pflanzen auf Sauerstoffgehalt, Wasserstoff-Ionen-Konzentration und die Lebensmöglichkeit anderer Gewächse. — Ber. d. Oberhess. Ges. f. Nat. u. Heilk. zu Giessen Naturwiss. Arb. *32*, 90—141.

KOPECKÝ, K. (1960): Fytocenologická studie slatinných luk v severovýchodních Čechách. — Praha.

KOPECKÝ, K. (1965): Zur Ökologie der Makrophyten an Flussufern. — Preslia (Praha) *37*, 246—263.

KOPECKÝ, K. (1966): Ökologische Hauptunterschiede zwischen Rőhrichtgesellschaften flissender und stehender Binnengewässer Mittel-Europas. — Folia Geobot.-Phytotax. (Praha) *1*, 193—242.

KOPECKÝ, K. (1967a): Mitteleuropäische Flussrőhrichgesellschaften des Phalaridion arundinaceae-Verbandes. — Limnologica (Berlin) *5*, 39—79.

KOPECKÝ, K. (1967b): Einfluss langdauernder Überflutungen auf die Stoffproduktion von Glanzgraswiesen. — Folia Geobot.-Phytotax. (Praha) *2*, 347—382.

KOVÁCS, M. (1957): A nógrádi flórajárás Magnocaricion társulásai (Die Magnocariocion-Zönosen des Nograder Florendistrikts). — Bot. Közlem. *47*, 135—155.

KOZMA, A. and TÖLGYESI, GY. (1979): Plant associations of flood plaints along the Middle Tisza and their agricultural utilization. — Tiscia (Szeged) *14*, 105—122.

LOHMEYER, W. (1950): Das Polygoneto Brittingeri — Chenopodietum rubri und das Xanthieto riparii — Chenopodietum rubri zwei flussbegleitende Bidention-Gesellschaften. — Mitt. Flor.-soc. Arbeitsgem. Stolzenau/Weser *2*.

MARKOVIČ, L. (1975): O vegetaciji Bidention tripartiti u Hrvatskoj (Über das Bidention tripartiti in Kroatien). — Acta Bot. Croat. *34*, 103—120.
MÁTHÉ, I. (1956): Vegetációtanulmányok a nógrádi flórajárás területén, különös tekintettel rétjeinek, legelőinek ökológiai viszonyaira (Studies on the vegetation in Nógrád County, with special regard to the ecological conditions in its meadows and pastures) (in Hungarian only). — MTA IV. oszt. Közlem. *9*, 2—56.
MÁTHÉ, I. und KOVÁCS, M. (1960): Vegetationsstudien im Mátra-Gebirge. — Acta Bot. Acad. Sci. Hung. *6*, 343.
PIETSCH, W. (1965): Beitrage zur Gliederung der europäischen Zwegbinsen-Gesellschaften. — Vegetatio *13*, 1—37.
Pietsch, W. (1973): Zur soziologie und ökologie der Zwergbinsen-Gesellschaften Ungarns (Klasse Isoëto-Nanojuncetea Br.-Bl. ex Tx. 1943). — Acta Bot. Acad. Sci. Hung. *19*, 269—288.
POLI, E. und TÜXEN, J. (1960): Über Bidentetalia-Gesellschaften Europas. — Mitt. d. Flor.-soz. Arbgem. *8*, 136—144.
SIMON, T. (1960): Die Vegetation der Moore in den Naturschutzgebieten der nördlichen Alföld. — Acta Bot. Acad. Sci. Hung. *6*, 107.
SOÓ, R. (1938): Vízi, mocsári és réti növényszövetkezetek a Nyírségben (Wasser-, Sumpf- und Wiesenpflanzengesellschaften des Sandgebietes Nyírség). — Bot. Közlem. *35*, 250—273.
SOÓ, R. (1964—1980): Synopsis systematico-geobotanica florae vegetationisque Hungariae I—VI. — Budapest (in Hungary).
SZALAY, M. (1957): A növénytársulástan mint a hidrológiai kutatás segédeszköze (Die Pflanzensoziologischen Hilfmittel der hydrologischen Forschung). — Hidrobiol. Közlöny *3*, 222—231.
TIMÁR, L. (1950): A Tisza-meder növényzete Szolnok és Szeged között (Les associations végétales du lit de la Tisza de Szolnok a Szeged). — Debr. Tud. Egyet. Biol. Int. Évk. *1*, 72—145.
TIMÁR, L. (1954): A Tisza hullámterének növényzete Szolnok és Szeged között. I. Vízi növényzet (Potametea Br.-Bl. et Tx.) (Die Vegetation des Flutraums der Tisza zwischen Szolnok und Szeged. I. Wasservegetation (Potametea Br.-Bl. et Tx.). — Bot. Közlem. *44*, 85—98.
TIMÁR, L. und BODROGKÖZY, GY. (1969): Die pfalnzengeographische Karte von Tiszazug. — Acta Bot. Acad. Sci. Hung. *5*, 203—232.
VICHEREK, J. (1962): Type fytocenos aluviálni nivy dolhino Podyji se Zvástnim zamerenim na spolecenstva lucni (Typen von Phytozönosen der alluvialen Aue des unteren Thya-Gebiets mit besonderer Berücksichtigung der Wiesenpflanzengesellschaften. — Folia. Fac. Sci. Nat. Univ. Purkynianae Brunensis, Biologia *3*, 1—113.
ZÓLYOMI, B. und PRÉCSÉNYI, I. (1964): Methode zur ökologischen Charakterisierung der Vegetationseinheiten und zum Vergleich der Standorte. — Acta Bot. Acad. Sci. Hung. *10*, 377—416.
ZÓLYOMI, B. et al. (1967): Einreihung von 1400 Arten der ungarischen Flora in ökologische Gruppen nach TWR-Zahlen. — Fragmenta Bot. *4*, 101—142.

A Mártélyi Tájvédelmi Körzet növénytakarója társulás talaj- és hidroökológiai viszonyainak változása az utolsó tíz év folyamán

BODROGKÖZY GY.

József Attila Tudományegyetem Növénytani Tanszék
Szeged, Magyarország

Kivonat

E vizsgálatok főleg a Körzet Körtvélyes szigetére összpontosultak. Feladata az itt kialakult, főleg lágyszárú növénytársulások valamint talajuk fizikai felépítése, nedvességellátottsága, a nátriumsók esetleges felhalmozódása és a különböző mérvű árvízborítottság és annak tartóssága közötti összefüggések tisztázása. — A különböző korú holt ágak közepesen gazdag vízinövény társulásai, a növényevő halak néhány évvel ezelőtt történt betelepítése után teljesen kipusztultak.

A sziget leghosszabb pangóvíz borítású, legkötöttebb öntéstalaján *Glycerietum maximae, Leucanthemo serotino-Alopecuretum pratensis, Carici-Typhoidetum arundinaceae* alakult ki. A rövidebb ideig pangóvizes zónában *Carici melanostachyae-Alopecuretum pratensis* s ezt követően a *Lythro virgatae-Alopecuretum pratensis* jelentkezett. A terasz-szerűen kialakult homok-

dűnék tartósan vízborította zónájában *Echinochloo-Bidentetum*, a folyópart öntéstalaján Elatini-Eleocharition ovatae asszociációk lelhetők fel.

Hidroökológiai viszonyaik tisztázására az Ellenberg, hazai viszonylatban Zólyomi és mt.ai rendszerét tovább fejlesztve a tíz kategórián belül 3-3 alegységet, így összesen 30 kategórián belőli egységet sikerült elkülöníteni, fajkomponenseik hidroökológiai görbéinek megszerkesztése révén.

Promene cenotičkih, pedoloških i hidroekoloških prilika biljnog pokrivača zaštićenog okruga Mártély u toku poslednjih deset godina

BODROGKÖZY GY.

JATE, Növénytani Tanszék, Szeged, Hungaria

Abstrakt

Ova istraživanje unutar zaštićenog okruga su se uglavnom ussredsredila na ostrvo Körtvélyes, sa zadatkom da razjasne medjuzavisnost izmedju lokalno nastale, uglavnom zeljaste biljne zajednice s jedne strane, i fizičkih osobina tla, vodnog režima, eventualnog nagomilavanja natrijumovih soli kao i različitih vodostaja i njihovog vremenskog trajanja s druge strane. Osrednje biljne zajednice mrtvaja različite starosti, nakon introdukcije biljojedih riba od pre nekoliko godina, potpuno su isčezle.

Na najvezanijoj plavnoj podlozi ostrva, gde se voda najduže zadržava, razvila se *Glycerietum maximae, Leucanthemo-serotino-Alopecuretum pratensis, Carici-Typhoidetum arundinaceae* zajednica. U zoni sa kraćim zadržavanjem vode javlja se *Lythro virgatae-Alopecuretum* pratensis nakon *Carici melanostachyae-Alopecuretum pratensis* zajednice. U trajno poplavljenoj zoni terasastih peščanih dina nalazi se *Echinochloo-Bidentetum*, dok je obala pod Elatini-Eleocharition ovatae asocijacijom.

Na osnovu konstrukcije hidroekoloških krivulja pojedinih vrsta, razradjivanjem sistema ELLENBERG-a odnosno ZÓLYOMI at al., uspelo nam je ukupno izdvojiti 30 unutarkategorijskih jedinica, odnosno izdvajanje od po 3 unutar 10 kategorija.

СМЕНЫ В ПОЧВЕННЫХ И ГИДРОЭКОЛОГИЧЕСКИХ ОТНОШЕНИЯХ РАСТИТЕЛЬНЫХ СООБЩЕСТВАХ ПРИРПДНО-ОХРАННОГО РАЙОНА МАРТЕЙ В ПОСЛЕДНЕМ ДЕСЯТИЛЕТИИ

Д. Бодрогкези

Кафедра ботаники университета им. Аттилы Йожефа, Сегед, ВНР

Резюме

Исследования в основнож концентрировались на острове Кёртвейеш. Задачи исследования заключались в основном, выяснении образования здесь травянистых растительных сообществ, физической структуры почв, состояния влаги и накопления в ней натриевых солей, а также причин происхождения разнообразных водных разливов и взаимосвязи между ними.

В разновозрастных старицах, в связи с засилением пару лет тому назад травоядных рыб, прежние растительные сообщества полностью были уничтожены.

В самой долговременной застойной воде острпва, в вязкой почве образовались расти тельные сообщества: *Glycerietum maximae, Leucanthemo serotino — Alopecuretum pratensis, Carici — Typhoidetum arundinacae.*

В коротко временно застойной воде встречаем *Carici melanostachyae — Alopecuretum pratensis* ~ а за ним следуемого *Lythro virgatae — Alopecuretum prantensis.*

В длительно заливной зоне, в террасах песчанных дюн появляется потом *Echinochloo-Bidentetum*, ~, а на прибережной насыпной почве *Elatini — Eleocharition ovatae* сообщество.

Для выяснения гидроэкологочеких отношений Элленберга — в местных отношениях систем Зольомия и др. — внутри 10 категории удалось отделить 3-3 подкатегории, всего 30 внутрикатегорных единицы — путем составления видокомпонентных и гидро экологических кривых.

Tiscia (Szeged) Vol. XVII, pp. 131—142 (1982)

QUANTITATIVE UND QUALITATIVE SAISONMÄSSIGE VERÄNDERUNG DES ZOOPLANKTONS IM ALTWASSER DER THEISS BEI KÖRTVÉLYES IM ZEITRAUM VON 1971 BIS 1976

D. GÁL

Zoologisches Institut Attila József Universität Szeged, Ungarn
(Eingegangen am 30. Okt. 1981)

Auszug

Aufgrund der sechs Jahre hindurch allmonatlich durchgeführten Untersuchungen sind die wichtigeren Charakteristika der quantitativen und qualitativen Veränderungen des Zooplanktons im Altwasser der Theiss bei Körtvélyes die folgenden:

In den meisten Fällen dominieren im Zooplankton — sowohl was die Arten- als auch die Individuenzahl anbelangt — die Rotatorien (oft machen sie 60—70% des Gesamtbestandes aus).

In der Veränderung der Gesamtindividuenzahl des Zooplanktons erscheinen jährlich gewöhnlich zwei Maxima: ein grösseres im Mai und ein kleineres im September.

Die Gesamtindividuenzahl ist im Winter am niedrigsten, ca. 8000 Ind./10 Liter; während der Maxima beträgt sie 66 000—75 000 Ind./10 Liter.

Die Überschwemmungen sind von grossem Einfluss auf die Gestaltung des Maxima: entweder verschieben sie sie auf einen späteren Zeitpunkt, oder bei langanhaltedem Hochwasser kann das Maximum auch ausbleiben.

Auch die saprobiologische Beschaffenheit des Wassers erfährt im Laufe des Jahres erhebliche Veränderungen. In den Wintermonaten dominieren bis zum Mai die oligosaproben und betamesosaproben Arten (o-b: 43,5%, b: 38,9%), die beta- und alphamesosaproben Arten sind nur in niedrigem Prozentsatz vertreten (13,9%). In den Sommermonaten wird die Qualität des Wassers allmählich schlechter, was ein Anwachsen der Zahl und Individuenzahl der für die beta-, bzw. alphamesosaproben Gewässer charakteristischen Arten nach sich zieht. Am schlechtesten ist die Qualität des Wassers des Altwassers im August, wo die Gesamtindividuenzahl der oligo-, und betamesosaproben Arten wesentlich abnimmt (32,7%) und statt ihrer die beta- bzw. alphamesosaproben Arten in Grösserer Individuenzahl erscheinen (37,8%).

Einleitung

Zur Erkennung der Lebewelt der Theiss gehört sterng auch die Kenntnis der Lebewelt des Altwassers entlang der Theiss; einerseits weil die Theiss einen Teil der innerhalb des Inundationsraumes gelegenen Altwassers regelmässig überschwemmt und anderseits, weil ein Grossteil des Altwassers oft das ganze Jahr hindurch mit der Theiss in Verbindung steht, kommuniziert. Aus einzelnen Altwasserzweigen fliesst die überflüssige Wassermenge über kleinere oder grössere Kanäle laufend in die Theiss und aus dem ausserhalb des Schutzdammes befindlichen Altwasser wird das überschlüssige Wasser mit Hilfe von Wasserhebeeinrichtungen in die Theiss hinübergepumpt. So kann das aus dem Altwasser in die Theiss gelangende Phyto- und Zooplankton die Lebewelt der Theiss weitgehend beeinflussen.

Frau SZÉKELY (1954) und MEGYERI (1961) hatten seinerzeit das Zooplankton des Altwassers der Theiss untersucht. Frau SZÉKELY hat anhand einjähriger regelmässiger Sammlungen die Rädertierfauna des Altwassers bei Gyálarét ufgearbeitet, während MEGYERI das Zooplankton von 9 Altwasser-zweigen entlang der Theiss aufgrund seiner Sammlungen im Sommer 1957 und 1958 studierte.

Um einen tieferen Einblick in das Zooplankton des Altwassers zu gewinnen, habe ich im Zeitraum von 1971 bis 1976 mitteils allmonatlicher Sammlungen die qualitativen und quantitativen Veränderungen des Zooplanktons des Altwassers bei Körtvélyes vervolgt.

Material und Methode

Das Altwasser der Theiss bei Körtvélyes liegt nördlich von Szeged am linken Flussufer zwischen dem 201. und 203. Flusskilometer auf der Fluss-seite des Schutzdammes (Abb. 1). Sie hat eine Hufeisenform, eine Länge von 6 km und im mittleren Abschnitt eine maximale Wassertiefe von gewöhnlich 3—3,5 m (bei Überschwemmungen der Theiss auch bis zu 6—8 m). Im mittleren Teil ist stets offenes Wasser anzutreffen, die beiden Enden und das Ufergebiet sind mit Pflanzen (*Trapa natans, Ceratophyllum* Arten usw.) bewachsen; das südliche Ende steht durch einen Kanal ständig in Berührung mit der Theiss, und durch den Kanal fliesst das überschüssige Wasser des Altwassers ab. Ein Wassernachschaub erfolgt hauptsächlich aus Niederschlägen sowie mit Hilfe der Wasserhebeeinrichtung eines Pumpwerkes, welches das Binnenwasser von ausserhalb den des Schutzdammes gelegenen Gebieten sammelt. Der hohe Wasserstand des Flusses verursacht häufig Überschwämmungen des Altwassers.

Während der Jahre 1971—1976 habe ich anhand allmonatlich vorgenommener Probentnahmen die qualitativen und quantitativen saisonmässigen Veränderungen des Zooplanktons des Altwassers untersucht. Die Sammlungen erfolgten im mittleren Teil des Altwassers an den beiden Ufern und in der Mitte selbst (Abb. 1) unter Verwendung eines Planktonnetzes No. 25. Meistens filterte ich 100 Liter Wasser durch das Netz, in den Sommermonaten aber wegen des reichhaltigen Phyto- und Zooplanktons nur 50 Liter. Des gesammelte Material wurde an Ort und Stelle in Formalin konserviert, die bei Aufarbeitung erhaltenen quantitativen Werte rechnete ich auf 10 Liter-Mengen um.

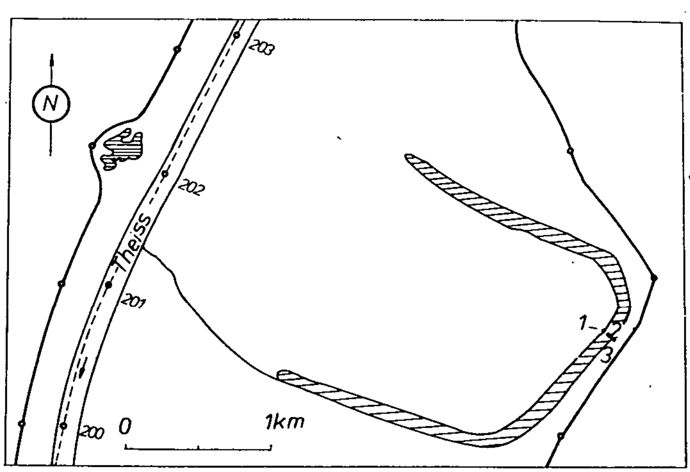


Abb. 1. Schematische Karte des Altwassers der Theiss bei Körtvélyes (Sammelstellen 1, 2, 3, —·—·— Schutzdamm).

Bewertung der Ergebnisse

Aufgrund der in der untersuchten Periode (Jan. 1971 bis Juli 1976) an drei Punkten des Altwassers bei Körtvélyes durchgeführten Sammlungen kamen 25 Rhizopoden (Testacea)-, 45 Rotatorien-, 14 Cladocera-, 7 Copepoda- und 3 Ostracodaarten bzw. -Varietäten zum Vorschein (Tabelle: Wegen Platzmangels sind in der Tabelle nur die Aufgrund ihres temporären und quantitativen Vorkommens berechneten durchschnittlichen Häufigkeitswerte angeführt). Ausser den obigen Taxongruppen kamen am häufigsten verschiedene Nematodenarten (von April bis November) vor, und zwar in den Sommermonaten in höherer Individuenzahl. Daneben fanden sich zeitweise auch einige Mückenlarven, die aber in der quantitativen Zusammensetzung des Zooplanktons niemals eine wesentliche Rolle spieltem.

Die häufigsten Arten, die allgemeinhin in jedem Monat des Jahres in kleinerer oder grösserer Individuenzahl im Altwasser bei Körtvélyes vorkommen, sind:

Rhizopoden: *Arcella discoides* (80—1600 Ind./10 liter), *Arcella vulgaris* (70—1800 Ind./10 Liter), *Centropyxis aculeata* (120—2500 Ind./10 Liter), *Difflugia gramen* 100—2800 Ind./10 Liter), *Difflugia lanceolata* (20—1200 Ind./10 Liter).

Rotatorien: *Brachionus angularis* (20—3800 Ind./10 Liter), *Colurella colurus* (10—1700 Ind./10 Liter), *Keratella cochlearis* (90—4500 Ind./10 Liter), *Keratella quadrata* (10—1700 Ind./10 Liter), *Lecane luna* (10—1600 Ind./10 Liter).

Cladocera: *Bosmina longirostris* (20—4800 Ind./10 Liter).

Copepoden: ihre verschiedenen Entwicklungsformen (Nauplius, Copepodit) sind in mehr oder minder grosser Individuenzahl zu jeder Jahreszeit anzutreffen. Ihre entwickelten, geschlechtsreifen Exemplare sind hauptsächlich vom Frühling bis zum Herbst häufiger.

Die obigen Arten sind in der Theiss, wie auch im übrigen Altwasser der Theiss allgemein verbreitet.

Seltene Arten, die nur vereinzelt und gewöhnlich in kleiner Individuenzahl im Altwasser lebten, sind:

Rhizopoden: *Arcella dentata* (April 1972: 4 Ind./10 Liter), *Arcella gibbosa* (Mai 1973: 8 Ind./10 Liter; August 1975: 12 Ind./10 Liter), *Cyphoderia laevis* (Juni 1973: 4 Ind./10 Liter; August 1975: 223 Ind./10 Liter), *Cyphoderia margaritacea* (Juli 1972: 82 Ind./10 Liter und Juli 1974: 820 Ind./10 Liter), *Trinema enchelys* (Juli 1971: 32 Ind./10 Liter und Nov. 1973: 25 Ind./10 Liter).

Rotatorien: *Brachionus quadridentatus* (Mai 1973: 286 Ind./10 Liter und Juni 1973: 84 Ind./10 Liter), *Filinia terminalis* (Apr. 1974: 48 Ind./10 Liter und Mai 1973: 12 Ind./10 Liter), *Lecane curvicornis* (Mai 1974: 38 Ind./10 Liter), *Lecane tenuiseta* (Juli 1972: 5 Ind./10 Liter), *Lecane ungulata* (Apr. 1972: 8 Ind./10 Liter), *Mytilina mucronata* (Mai 1976: 86 Ind./10 Liter), *Mytilina ventralis* (Juli 1975: 32 Ind./10 Liter), *Testudinella patina* (Juli 1974: 32 Ind./10 Liter und Aug. 1974: 328 Ind./10 Liter), *Tetramastix opoliensis* (Aug. 1976: 7 Ind./10 Liter), *Trichocerca birostris* (Juli 1971: 4 Ind./10 Liter), *Trichocerca bicristata* (Mai 1973: 12 Ind./10 Liter), *Trichocerca rattus* (Aug. 1971: 18 Ind./10 Liter), *Trichocerca tenuior* (Sept. 1975: 8 Ind./10 Liter).

Cladocera: *Diaphanasoma brachyurum* (Juni 1971: 326 Ind./10 Liter und Juli 1971: 26 Ind./10 Liter), *Pleuroxus laevis* (April 1975: 286 Ind./10 Liter), *Simocephalus vetulus* (Juli 1971: 5 Ind./10 Liter).

Copepoden: *Metacyclops gracilis* (Mai 1975: 3 Ind./10 Liter).

Diese seltenen Arten sind gelegentliche Koloritelemente im Zooplankton des

Altwassers bei Körtvélyes. Sie erscheinen periodisch und unregelmässig und meist in so niedriger Individuenzahl, dass sie die Gesamt-Zooplanktonmenge nicht wesentlich beeinflussen.

In der Regel bestand kein nennenswerter Unterschied in der Gesamtmenge des Zooplanktons der drei Sammestellen, auch die Artenzusammensetzung stimmte ca. 90% überein; eine Abweichung ergab sich lediglich in den seltener und in geringer Individuenzahl vorkommenden Arten (Abb. 2 A). Die wesentlichste Abweichung war im August 1972 zu verzeichnen, als an der Sammelstelle 1 die Gesamt-Zooplanktonmenge sozusagen minimal war (1800 Individuen in 10 Liter), an der Sammelstelle 2 (Mitte) ein starker Anstieg mit annähernd 60 000 Ind./10 Liter bestand und an der Sammelstelle 3 die Individuenzahl reichlich über 60 000 Ind./10 Liter betrug. Dies ist vielleicht dem Umstand zu-zusprechen, dass während des Sammelns ein sehr starker Westwind blies, der das Wasser aufpeitschte und die Exemplare des Zooplanktons von der ersten Sammelstelle zur dritten schwemmte (Abb. 2 B).

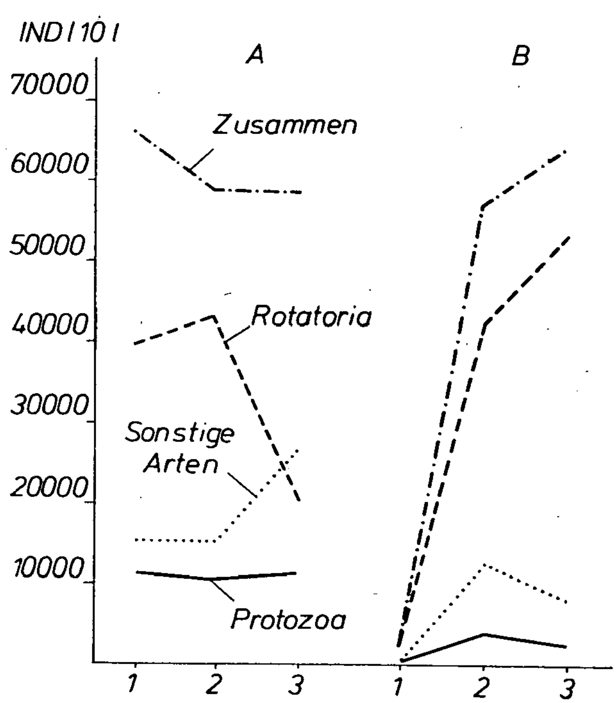


Abb. 2. Quantitative Verteilung des Zooplanktons an den einzelnen Sammelstellen (A: durchschnittliche Verteilung; B: Zustand im August 1972).

Im Zooplankton dominieren sowohl hinsichtlich der Arten- als auch der Individuenzahl im grössten Teil des Jahres die Rotatorienarten, meistens bilden sie 60—70% des Zooplanktons. Die Entomostraca-Arten sind gewöhnlich in mittlerer Individuenzahl vertreten; manchmal — vorwiegend in den Frühjahrs- und Herbstmonaten — übertrifft ihre Gesamtindividuenzahl jene der Rotatorien. In den meisten Fällen verursacht die höhere Individuenzahl einiger weniger Arten eine Massenvermehrung. Besonders die zeitweilige enorme Vermehrung der *Bosmina longirostris* der *Daphnia longispina* und der *Megacyclops viridis* ist bedeutend. In der erwähnten Zeit erscheinen sie oft mit einer Individuenzahl von 18—20 000/10 Liter. Neben diesen Arten ist die fast ständige Anwesenheit und das zeitweilig massenhafte Erscheinen der Copepodenlarven bedeutsam. Fallweise kann ihre Zahl bis zu 20 000 Individuen/10 Liter erreichen. Die vollentwickelten, geschlechtsreifen Formen der Copepoden sind weitaus seltener; die einzelnen Arten kommen in weit kleineren Individuenzahlen vor als die Larvenformen. Dies deutet darauf hin, dass den Larvenformen eine wesentliche Rolle in der Ernährungskette zukommt: im Laufe ihrer Entwicklung werden sie grösstenteils von Raubtieren verzeht (wahrscheinlich haupsächlich von den Fischen).

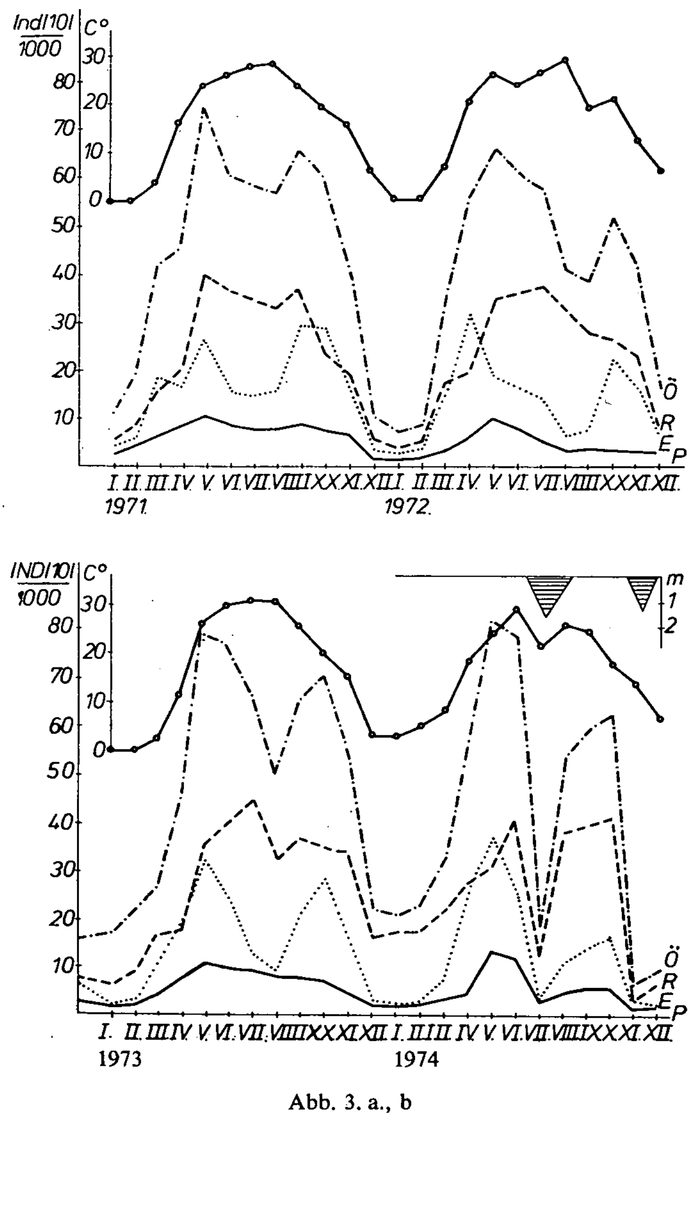


Abb. 3. a., b

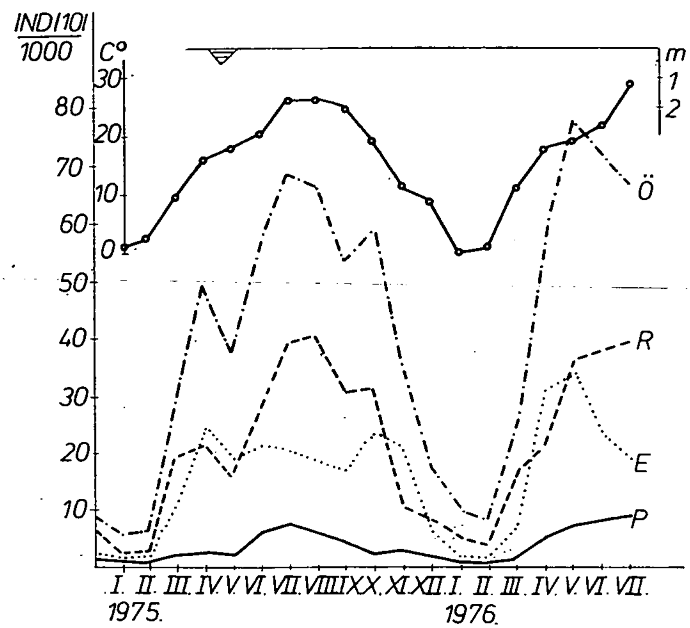


Abb. 3. a, b, c. Quantitative und qualitative Veränderung der Zooplanktonzusammensetzung in den einzelnen Monaten der Jahre 1971—1976 (Ö = Gesamtindividuenzahl, P = Protozoen, R = Rotatorien, E = Entomostraca, ▽ = Dauer und Ausmass der Überschwemmung durch die Theiss).

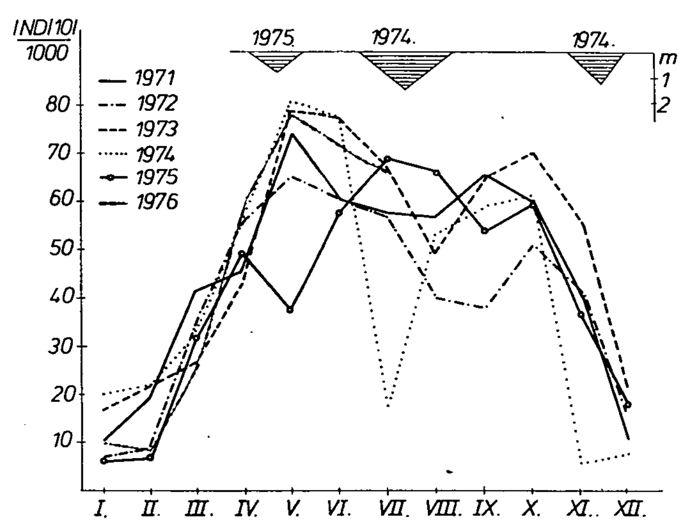


Abb. 4. Jährliche und monatliche Schwankungen der Gesamtzooplanktonmenge.

Die Testaceenarten machen in der Regel nur einen kleinen Prozentsatz des Zooplanktons (5—10%) aus, und auch ihre Individuenzahl ist gering.

Im Laufe des Jahres erfährt die qualitative, insbesondere aber die quantitative Zusammensetzung des Zooplanktons des Altwassers eine wesentliche Veränderung (Abb. 3a, b, c und Abb. 4). Für die Wintermonate ist die kleine Arten- und die geringe Individuenzahl charakteristisch. Die durschnittliche Gesamtindividuenzahl bewegt sich um 8000—10 000 Ind./10 Liter. In den Frühjahrsmonaten kommt es zu einem erheblichen Anstieg der Arten- und auch der Individuenzahl, die Gesamtindividuenzahl erreicht zu dieser Jahreszeit gewöhnlich ihren Höchstwert, oft 75 000—78 000 Ind./10 Liter. In der Erhöhung der Gesamtindividuenzahl spielt ausser der Zunahme der Individuenzahl der Rotatorienarten auch der enorme Anstieg der Entomostraten Arten und ihrer Individuenzahlen eine wesentliche Rolle. In den Sommermonaten gehen die Arten- und Individuenzahlen — besonders wegen der kleineren Arten- und Individuenzahl der Entomostraca — erheblich zurück. In den Herbstmonaten — vom September an — ist wiederum ein gewisser Anstieg des Gesamtindividuenzahl zu beobachten und es bildet sich ein zweites Maximum heraus, das aber im allgemeinen niedrigere Werte aufweist als das Frühjahrsmaximum.

Die Gestaltung der Gesamtindividuenhöchstwerte wird von den längeren Hochwassern stark beeinflusst. Die einige Tage dauernden kleineren Überschwemmungen bringen keine wesentliche Veränderung in der Gestaltung der Maxima zustande. Nach dem Abfluss der Hochwassermassen ist die ursprüngliche Gesamtindividuenzahl des Zooplanktons binnen relativ kurzer Zeit wiederhergestellt. Hält das Hochwasser längere Zeit an — wie z.B. 1974 zweimal und dann 1975 (Abb. 4) —, so geht die Gesamtmenge des Zooplanktons bedeutend zurück, und die sonst üblichen Maxima erscheinen wesentlich später.

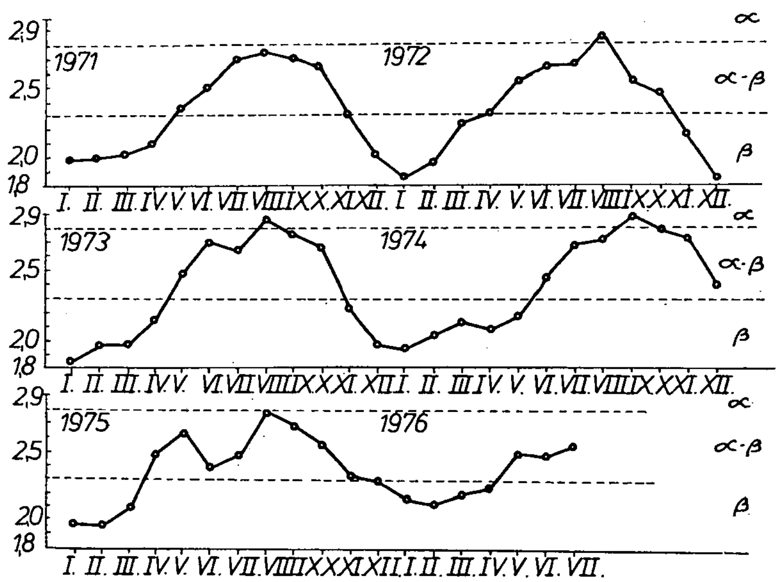


Abb. 5. Monatliche Veränderung des aufgrund des saprobiologischen Indikatorwertes der im Altwasser der Theiss bei Körtvélyes lebenden Zooplanktonarten errechneten saprobiologischen Indexes während der Jahre 1971—1976.

Eine beträchtliche Veränderung erfährt im Laufe des Jahres auch die saprobiologische Qualität des Altwassers bei Körtvélyes (Abb. 5). (Bei der Errechnung des saprobiologischen Indexes bediente ich mich der Pantle-Buck'schen Methode.) In den Winter-, Frühjahrs- und den letzten Herbstmonaten ist die Beschaffenheit des Wassers gewöhnlich beta-mesosaprob (der saprobiologische Index wechselt zwischen 1,85 und 2,30). Es dominieren vornehmlich die oligo-beta- und beta-mesosaproben Zooplanktonarten (Abb. 6 A). Vom Monat Mai an ist eine allmähliche Verschlechterung der Wasserqualität festzustellen, die ihr Maximum meistens im August erreicht. In dieser Phase nimmt die Zahl der oligo-beta-mesosaproben Arten und ihre Individuenzahl stark ab, an ihrer Stelle erscheinen die beta-alpha-mesosaproben Arten, oft aber sind auch die Vertreter der polysaproben Arten anzutreffen (Abb. 6 B).

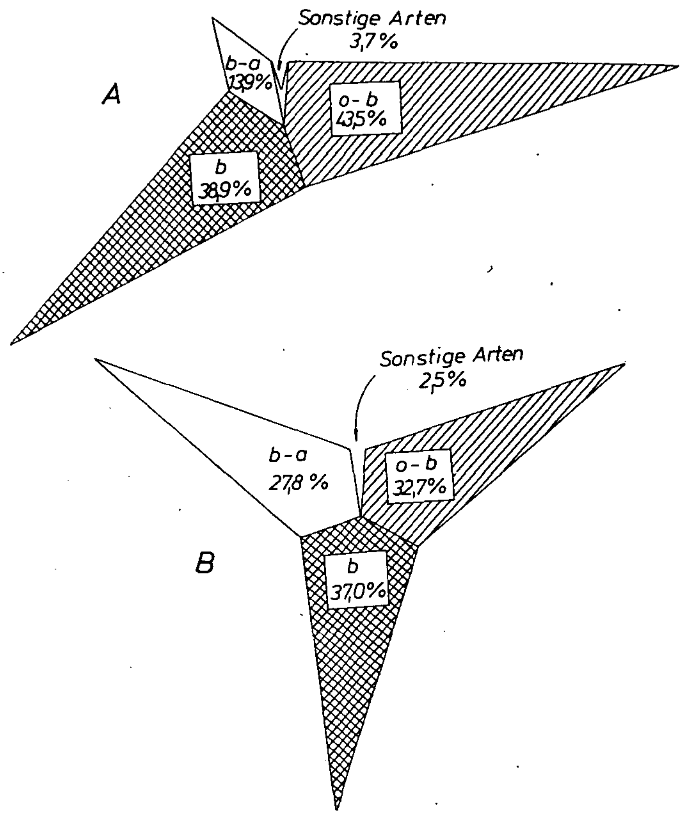


Abb. 6. Allgemeine prozentuelle Verteilung der Arten nach ihrem saprobiologischen Indikatorwert. A: im April, B: im August.

Tabelle. *Die durchschnittlichen monatlichen Häufigkeitswerte der Arten des Zooplanktons des Altwassers bei Körtvélyes: 1. Sehr selten (1—2 mal, 1—100 Ind./10 Liter), 2. Selten (2—3 mal, 1—200 Ind./10 Liter), 3. Häufig (2—3 mal, 150—400 Ind./10 Liter), 4. Sehr Häufig (3—4 mal, 300—500 Ind./10 Liter), 5. Massenhaft (4—5 mal, gewöhnlich über 500 Ind./10 Liter).*

Rhizopoda — Monate:	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
Arcella costata EHRBG.			1			1	2				1	
Arcella dentata EHRBG.				1								
Arcella discoides EHRBG.	1	2	1	4	5	5	5	4	2	1	1	1
Arcella gibbosa PENARD					1			1				
Arcella hemisphaerica PERTY	1		1				3	2	3			1
Arcella vulgaris EHRBG.	1	1	2	3	2	4	5	2	1	3	1	1
Centropyxis aculeata STEIN	3	3	2	4	4	5	4	5	3	2	1	1
Centropyxis constricta DEFL.	1			1				1				2
Cyphoderia laevis Penard						1		3				
Cyphoderia margaritacea EHRBG.							4					
Difflugia acuminata EHRBG.	1	1	2			1				2		
Difflugia amphora LEIDY			1	3	2					2	4	1
Difflugia corona WALLICH			1				1					1
Difflugia globulosa DUJ.				1	3							
Difflugia gramen PENARD	2	3	2	1	4	4	3	4	4	3	3	1
Difflugia lanceolata PENARD	1	1	2	4	5	5	1	2	2	5	5	1
Difflugia lobostoma LEIDY		1	2	2		2	1			3		
Difflugia mammillaris PENARD										1	1	1
Difflugia pyriformis PERTY				1						2		
Euglypha alveolata LEIDY				3	1	2	1	1			2	
Euglypha brachiata LEIDY				1					2			
Euglypha ciliata EHRBG.			1	1		5			1			
Nebela collaris LEIDY				1								
Trinema enchelys EHRBG.						1					1	
Trinema lineare PENARD		1	2	1			1	2			2	1
Rotatoria												
Anureopsis fissa GOSSE	1			3			1					
Asplanchna priodonta GOSSE			1	2	1	3	1	3	2	2		1
Brachionus angularis GOSSE	1	3	2	1	3	3	4	5	5	1	4	2
Brachionus angularis v. *bidens* PLATE			1	2				2	1			
Brachionus calyciflorus PALLAS	1	2	1	3	4	3	5	1		1		
Brachionus calyciflorus v. *dorcas* WIERZ.					1	2	1					
Brachionus falcatus ZACH.				1	3	3	3	1				
Brachionus quadridentatus HERMANN					2	1						
Brachionus urceolaris MÜLLER	1	2	1	1	1	2			1	3	2	1
Colurella colurus EHRBG.	1	1	1	2	1	2	3	1	2	1	2	1
Colurella uncinata EHRBG.				1	2							
Euchlanis dilatata EHRBG.				1	2	1	1	2				
Filinia longiseta EHRBG.			1	3	4	3						
Filinia terminalis PLATE				1	1							
Keratella cochlearis GOSSE	2	1	3	4	5	3	2	4	2	1	1	2
Keratella quadrata MÜLLER	1	2	2	5	5	4	2	1	3	1	1	1
Keratella valga EHRBG.				1	1	1						
Lecane bulla GOSSE			1		2			3				
Lecane curvicornis MURRAY					2							
Lecane hamata STOKES							1					
Lecane luna MÜLLER	2	1	1	3	5	1	1	5	4	1	2	3
Lecane quadridentata EHRBG.									1	3		
Lecane tenuiseta HARRING							1					
Lecane ungulata GOSSE				1								
Lepadella ovalis MÜLLER		1		2	3				1			
Lepadella patella MÜLLER	1	1	2	1	2				1	2	3	1

Monate:	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
Mytilina compressa GOSSE					1							
Mytilina mucronata MÜLLER					1							
Mytilina ventralis EHRBG.							1					
Notholca acuminata EHRBG.			1	2	1				1	1	2	
Pedalia mira HUDSON						1	3				1	
Philodina roseola EHRBG.				2	1	2	3	1	2			
Philodina citrina EHRBG.			2	1	3			4	2	1		
Platyas quadricornis EHRBG.			1	2								
Polyarthra dolychoptera IDELSON	1	1	2	4	3	5	1	1	3	1		1
Polyarthra euryptera WIERZ.			1		2	3			1	3		
Rotaria neptunia EHRBG.	1		2	3	3	4	5	5	3	2	1	1
Schizocera diversicornis DADAY		1		2	3	2	5	2	1		1	
Testudinella mucronata GOSSE				1								
Testudinella patina HERMANN							1	2				
Tetramastix opoliensis ZACH.								1				
Trichocerca birostris MINK.							1					
Trichocerca bicristata GOSSE					1							
Trichocerca rattus MÜLLER								1				
Trichocerca tenuior GOSSE									1			
Cladocera												
Alona rectangula SARS			2	1	1							
Bosmina longirostris MÜLLER	1	2	3	4	5	3	4	3	2	1	2	1
Ceriodaphnia quadrangula MÜLLER			1	2	1							
Chydorus sphaericus MÜLLER		2	4	5	5	3	1		2	1		
Daphnia longispina MÜLLER		1		1	5	5			3	2	1	
Daphnia magna STRAUS	1			2	3	1	1		2	1		
Diaphanosoma brachyurum LIEVIN						2	1					
Graptoleberis testudinaria FISCHER							1	1				
Moina rectirostris LEYDIG		1	2	1	3	1	1		2	1		
Peracantha truncata MÜLLER									2	1		
Pleuroxus laevis SARS				2								
Scapholeberis mucronata MÜLLER			1	3	1	1						
Sida cristallina MÜLLER			1	2	3							
Simocephalus vetulus MÜLLER							1					
Copepoda												
Acanthocyclops vernalis FISCHER			1	2	4	2	1					
Eucyclops serrulatus FISCHER		1	2	4	1			2				
Eudiaptomus gracilis SARS			1	3	4	2					1	
Macrocyclops albidus JURINE						2	1					
Megacyclops viridis JURINE			1	3	5	1			1	2		
Metacyclops gracilis LILLJEBORG								1	2		2	
Thermocyclops oithonoides SARS					1							
Nauplius LARVEN	1	2	4	5	5	5	4	4	5	5	3	2
Ostracoda												
Cyclocypris ovum JURINE			1	2	3					1		
Cypricercus fuscatus SARS						2	1					
Cypris pubera MÜLLER					1	2	1					
Nematoda spp.				1	1	2	3	3	1	1	1	

Literatur

CHARDEZ, D. (1964): Thecamoebiens. — Expl. hydrobiol. Bangweolo-Luapula *10*, 1—77.
DÉVAI, I. (1977): Az evezőlábú rákok (Calanoida és Cyclopoida) alrendjeinek kishatározója (Kleines Bestimmungsbuch der Ruderfüssler-Krebse Calanoida und Cyclopoida). — Budapest.
FLÖSSNER, D. (1972): Krebstiere, Crustacea: Kiemen- und Blattfüsser, Branchiopoda, Fischläuse, Branchiura. — In Dahl, F.: Die Tierwelt Deutschlands. 60. Teil.
GROSPIETSCH, TH. (1958): Wechseltierchen (Rhizopoden). — Stuttgart.
GULYÁS, P. (1974): Az ágascsápú rákok (Cladocera) kishatározója (Kleines Bestimmungsbuch der Wasserflöhe-Krebse Cladocera). — Budapest.
HARNISCH, O. (1961): Rhizopoda. — In Brohmer, P., Ehrmann, P., Ulmer, C.: Die Tierwelt Mitteleuropas. — Leipzig.
MEGYERI, J. (1961): Vergleichende hydrofaunistische Untersuchungen in den Toten Armen der Tisza. — A Szegedi Pedagógiai Főiskola Évkönyve, *2*, 121—133.
PENARD, E. (1902): Fauna Rhizopodique. — Geneve.
PESTA, O. (1928, 1932, 1934): Krebstiere oder Crustacea, I: Ruderfüsser oder Copepoda. — In DAHL, F.: Die Tierwelt Deutschlands. 9., 24., 29. Teil.
SZÉKELY, L. (1954): A szegedi Holt-Tisza kerekesférgei (Die Rädertiere der Szegeder Toten Theiss). — Annales Biological Universitatum Hungariae, *2*, 479—490.
VOIGT, M. (1956): Rotatoria. Die Rädertiere Mitteleuropas. — Berlin—Nicolassee.

A Körtvélyesi Holt-Tisza zooplanktonjának kvalitatív és kvantitatív szezonális változásai az 1971—76-os években

D. GÁL

József Attila Tudományegyetem, Állattani Tanszék, Szeged, Magyarország

Kivonat

Hat éven át végzett havonkénti vizsgálatok alapján a Körtvélyesi Holt-Tisza zooplanktonjának mennyiségi és minőségi változásainak főbb jellemzői a következők.

A zooplanktonban a legtöbb alkalommal a Rotatoria fajok dominálnak, mind faj-, mind egyedszámban (gyakran a zooplankton 60—70%-át alkotják).

A zooplankton összegyedszám változásában évente általában 2 maximum jelentkezik: májusban egy nagyobb és szeptemberben egy kisebb.

Az összegyedszám télen a legalacsonyabb, kb. 8000 ind/10 liter, a maximumok idején 66—75 000 ind/10 liter.

Az árvizek a maximumok kialakulását nagymértékben befolyásolják, későbbi időpontra tolják, vagy hosszantartó árvíz esetén a maximum el is marad.

Az év folyamán a víz szaprobiológiai minősége is lényegesen változik. A téli hónapokban májusig az oligo-szaprob és béta-mezoszaprob fajok dominálnak (o—b: 43,5%, b: 38,9%), a béta-, alfa-mezoszaprob fajok csak kis százalékban vannak jelen (13,9%). A nyári hónapokban fokozatosan romlik a víz minősége, megnövekszik a béta-, alfa-mezoszaprob vizekre jellemzőbb fajok száma és egyedszáma. Legrosszabb a holt ág vizének minősége augusztusban, amikor az oligo-, béta-mezoszaprob fajok összegyedszáma jelentősen csökken (32,7%), s helyettük a béta-, alfa-mezoszaprob fajok jelennek meg nagyobb egyedszámban (37,8%).

Kvalitativne i kvantitativne sezonske promene zooplanktona mrtvaje reke Tise Körtvélyes u periodu 1971—1976. godine

GÁL D.

JATE, Katedra za zoologiju, Szeged, Hungaria

Abstrakt

Na osnovu mesečnih ispitivanja kvantitativnih i kvalitativnih promena zooplanktona mrtvaje reke Tise Körtvélyes utvrdjeno je:

— U zooplanktonu najčešće dominiraju Rotatoria, kako u odnosu na broj vrsta, tako i u pogledu broja jedinki (često sačinjavaju 60—70% zooplanktona);

— U godišnjoj dinamici promene količine zooplanktoma javljaju se dva maksimuma: veći u maju, manji u septembru;

— Ukupan broj jedinki je zimi najmanji, cc 8000 inddiv/lit, dok za vreme maksimuma iznosi 66—75 000 ind/l.;

— Poplave u znatnoj meri utiču na razvoj maksimuma, vremenskim pomeranjem ili čak izostajanjem u slučaju dugotrajnih poplava.

I saprobiološko svojstvo vode se znatno menja u toku godine. U toku zimskih meseci do maja dominiraju oligo-, beta-mezosapro vrste (o—b: 43,5%, b: 38,9%), dok su beta-, alfa mezosaprobne vrste prisutne u malom procentu, 13,9%. U toku letnjih meseci postepeno dolazi do opadanja kvaliteta vode. Pojavljuje se veći broj vrsta sa povećanim brojem jedinki karakteristične za beta-, alfa-mezosaprobne vode. Najlošiji kvalitet vode u mrtvaji se javlja u avgustu, kada se znatno smanjuje ukupan broj oligo-, beta-mezosaprobnih vrsta (32,7%), i mesto njih se javljaju beta-, alfa-mezosaprobne vrste sa povećanim brojem jedinki (37,8%).

СЕЗОННЫЕ КОЛЛИЧЕСТВЕННЫЕ И КАЧЕСТВЕННЫЕ ИЗМЕНЕНИЯ В ЗООПЛАНКТОНАХ В КЁРТВЕЙШЕВСКОЙ СТАРИЦЕ РЕКИ ТИСЫ В 1971 Д1976 ГОДАХ

Д. Гал

Кафедра зоологии университета им. Аттилы Йожефа, Сегед ВНР

Резюме

Ежемесячные исследования зоопланктона Кёртвейешской старицы реки Тисы в течении шести лет дали следующие результаты.

В зоопланктоне в большинстве случаев доминируют виды Rotatoria (довольно часто образуют 60—70%).

В общем количестве, зоопланктоне ежегодно показывает 2 максимума: в мае один большой, а в сентябре — один меньший. Самый низкий состав зимой — 8000 единиц (в 10 литрах воды), а максимальное состояние — 66—75 000 единиц (в 10 литрах воды).

Наводнения в значительной мере влияют на образование максимумов, переставляя их на более позднее время, а в слйчае длительных наводнений даже на задержку.

На протяжении одного года, сапробиологическое качество воды существенно меняется. Зимой — до мая доминируют олигосапробные и бета-мезосапробные виды (о — б: 43,5; (о — б: 43,5; б: 38,9%), а бета-альфа мезосапробные виды присутствуют только в малом количестве (13,9%). Летом постепенно портится качество воды — увеличивается количество бета и альфа мезосапробных видов (32,7%), а на их местах в большом количестве появляются виды бета и альфа мезосапробные (37,8%).

Tiscia (Szeged) Vol. XVII. pp. 143—154 (1982)

CERAMBYCID BEETLES DEVELOPING ON THE WILLOW, SALIX ALBA IN KÖRTVÉLYES

B. GASKÓ

Museum Ferenc Móra, Szeged
(Received 10 October, 1981)

Abstract

Survey of Cerambycid beetles developing on willow *(Salix alba)* was taken in the flood plain of Körtvélyes between 1974 and 1980. Determination of the species using *S. alba* as host plant was taken by rearing. Some species developing for more than one year were identified as larvae. In the case of monophagous species and pests, data collected from food plants were sufficient. 25 Cerambycidae developing on *S. alba* were found at Körtvélyes. The majority (84%) of the species developed in fallen branches and twigs. Though xylophagous cerambycids were safe of inundation in their critical larval and pupal stages this protection was not absolute. Especially the species developing in brush-wood for more than one year and the flightless Cerambycidae were often killed by floods (8 and 4%, respectively). *S. alba* plant chemicals can prevent the development of certain species. In consequence, a large, homogenous stand would protect planted forests as well.

Introduction

When founding population, a coleopteran (in our case a cerambycid beetle) in a given territory depends on several interacting factors.

For monophagous species (or nearly monophagous one) the most important factor is the presence of its host plant.

Salix communities were dominant in Csongrád county along the river Tisza — so in Körtvélyes as well — until the river's regulation. The only larger forests in our country — mentioned by M. BÉL (1732b) — were the willows of the Tisza flood plain. Areas near to the sea level, covered by water, supported larde reedbeds. According to his descriptions, in the neighbouring Csanád county the oak forests dominated though they were considered as planted (BÉL 1732a).

In the abovementioned years the valley of the river Maros was mostly covered by forests up to the foothills of Carpathians. This is proved by the 1. military mapping survey taken under the reign of King JOSEPH II (1783—84), and by ZAKARIAS JOHANN Sax's map of 1787.

These maps showed wetlands with a very limited number of trees along the Tisza south of the mouth of the river Kőrös. The same is characteristic for the hydrological- and forestry conditions along the middle and lower course of the Tisza, according to UHERKOVICH's division (1971). In spite of the modifyinf effect to the regulation, the difference between the two territories still exist. While *Salicetum albae-fragilis* and *Salicetum triandrae* communities, together with their different facieses and non-natural consociations, are dominant along the Tisza flood plain in Csongrád county (TIMÁR 1953, BODROGKÖZY 1966). The same is characteristic for the gallery woods along the Maros up to the 35. river kilometer only.

This homogenous forest stand caused that the question of food plants was worth serious consideration also for oligophagous and polyphagous species. Almost all the entomologists working in Szeged were interested in the modifying effect of the floods originating from two factors: the immigration and the selective factors. In the following only the data of xylophagous components of the entomofauna are to be mentioned.

1. Immigration

(a) species gain by floods

According to Csiki (1906) "a great many species living in the mountains are carried by the floods of rivers Tisza and Maros". STILLER (1926, 1939) also stated that many coleopterans were carried by the floods to our country adding that "these passively imported strangers" could not establish themselves (STILLER 1939).

The possibility of drifting is supported by ERDŐS (1935) in the case of the river Maros. He hypothesized that the river Tisza had no fundamental importance in this respect, its waterflow being slow and having a long path trhough the lowland where its deposit could be layed. He considered beetles developing in wood to be relatively protected from floods.

As a summary, we can state that each year a great number of coleopterans are drifted by rivers (especially by the Maros) to our county. This can be considered as a special way of immigration. Neither ERDŐS (1935) nor I have found xylophagous cerambycid beetles in the flood deposits. This is logical for the species able to fly. Fluctuating numbers of *Dorcadion* species were found during the spring floods.

A better possibility of passive immigration can be provided by rafts or floating timbers. Probably this was the way by which *Tetropium castaneum* (L.) reached the mouth of Maros (VÁNKY—VELLAY 1894), though it could not establish itself. Considering the flood plain conditions, even the establishment of some flightless xylophagous cerambycids drifted ashore should be impossible.

(b) species gain by other means

In the valley of the Maros even the possibility of being drifted by water is not a necessary condition.

Its flood plain has a special microclimate (ANDÓ 1969). Some xylophagous species can reach the county via the gallery wood habitat islands. The "green stripe" from the Transsylvanian forests to the valley of Tisza would help them. This way specimens of oligophagous and polyphagous species inhibitants of small branches, twigs and sticks would immigrate.

At Körtvélyes the Kőrös river can increase the numbers transported this way but, unfortunately, there are no data available. Settlements along the rivers may act as importing centres. Many cerambycid beetles are imported by firewood and orchards and vineyards provide also possibility for population foundation. For example, BODNÁR (1939) mentioned that *Phytomatodes fasciatus* (VILL.) was abundant near the Tisza at Hódmezővásárhely and the neighbouring orchards.

2. Selection

Though xylophagous longhorned beetles are protected from floods in their critical larval and pupal stages, this protection is not complete. The problem will be discussed under the Results section. The food specialization is of importance at the population level (GILJAROV 1954). The plant chemicals in general, will prevent the development in many phytophagous insect species (JERMY 1972) so it can be stated that the *S. alba* plant chemicals play a selective role. In consequence, a large amd homogenous stand of *S. alba* would protect the neigbouring forests, too.

Material and Method

As a consequence of the bionomics of most Ceramybcidae, the main sampling methods in the faunal inventories is the hand picking. In xylophagous species the examination of trunks and heaps is the most useful collecting method (MEDVEGY 1979).

Especially in brush-wood heaps stored for the purposes of Flood Preventing Service develop many, otherwise rare longhorned beetles. In 1934 Stiller collected a new species *Molorchus salicicola,* probably from these heaps. Describing the bionomics of the species he mentioned (STILLER 1935) that brush-wood haeps were favourite collecting sites. He was the first to mention Cerambycidae developing on *S. alba* at the surroundings of Szeged and these were: *Megopis scabricornis* (SCOP), *Strangalia quadrifasciata* (L.) (STILLER 1926), *Molorchus salicicola* (STILLER) (STILLER 1934, 1935, 1939), *Rhopalus macropus* (GERM.), *Chlytus arietis* (L.) (STILLER 1935).

The final proof concerning the food plants can, with rare exceptions, be obtained by rearing. I carried out rearings in the traditional way.

Under natural circumstances many xylophagous species can be collected only on flowers. Quadrat sampling is useless because of their preference towards certain plant species and sweep netting results are fluctuating both quantitatively and qualitatively. So all the flowering plants must be examined. This way some species not strictly flower-visiting could also be collected. Among these, I have found *Obrium cantharinum* (L.) (6 specimens), *Rhopalopus clavipes* (FABR.) (3 specimens), *R. macropus* (GERM.) (2 specimens) and *Exocentrus punctipennis* (MULS.) (8 specimens) on different flowers. *Aromia moschata* is also often found on flowers but rather as "resting" there than as real flower-visiting species. An interesting phenomenon was observed in *Phymatodes puncticollis* (MULS.) and *Obrium cantharinum.* In cloudy weathers with high air pressure the adults prefer to stay and copulate on different green plants covering the lower parts of the brushwood heaps stored outdoors. In 1975, three brush-wood heaps infected with *Oberea oculata* (L.) were found in New-Szeged. Two small saplings of white poplar grew 5—6 meters from the central heap where I collected almost all the freshly developed, flying adults. The same preference towards the green cover is characteristic for *A. moschata.* Under laboratory circumstances, in choice experiments the same results were obtained.

Sampling of the study site was carried out between 1974 and 1980.

Results

The present paper deals with the data of Cerambycidae developing on *S. alba* reared from samples taken in Körtvélyes or collected there. I compared these data with two other samplings to find whether the abovementioned mechanisms of species range expansion were real ones or not. Data from the Vetyehát flood plain contained beetles collected on willow only while those from the forest belt near the dike around Szeged contained material collected on other tree species because the willow did not occur in the belt (Table 1).

When attepmting to find the host palnt species, rearing should be the final proof.

In some species which develop for more than one year, rearing is too dificult. Here the didentification was performed in their larval stage. For monophagous (or nearly monophagous) species and some pest species rearing was not always necessary. I have found 6 such species in the Körtvélyes samples and considered them as developing on *S. alba* though no proof from rearings was obtained (Table 2).

When considering the importance of cerambycid beetles as forest pests, the exact position where tehir development takes place must be identified. This "niche" does not always coincide with those obtained in other host plants because of the inhibitory effect of the plant chemicals in *S. alba* (Table 3).

Table 1. *The abundance classes for Cerambycidae developing on the willow S. alba at Körtvélyes and at two control sites*

+++ common ++ fairly abundant + rare – lacking

Species	Körtvélyes	Vetyehát flood plain of the Maros	forest belt at the dike round Szeged
Megopis scabricornis (SCOPOLI 1763)	++	++	+++
Leptura livida (FABRICIUS 1776) ssp. *pecta* (K. J. DAN.)	+++	+++	+++
Strangalia quadrifasciata (LINNÉ 1758)	++	++	+++
Gracilia minuta (FABRICIUS 1780)	+	+	+
Obrium cantharinum (LINNÉ 1767)	++	+++	+
Nathrius brevipennis (MULSANT 1839)	+	+	+
Stenopterus flavicornis (KÜSTER 1846)	+++	+++	+++
Molorchus salicicola (STILLER 1934)	+++	+++	+
Aromia moschata (LÍNNÉ 1758)	+++	+++	+++
Rhopalopus clavipes (FABRICIUS 1775)	+++	+++	+
Rhopalopus macropus (GERMAR 1824)	+++	+++	+++
Phymatodes testaceus (LINNÉ 1758)	+++	+++	+++
Phytamodes puncticollis (MULSANT 1862)	++	+++	–
Phymatodes fasciatus (VILLERS 1789)	+	+	+
Xylotrechus rusticus (LINNÉ 1758)	+++	+++	+++
Chlytus arietis (LINNÉ 1758)	+++	+++	++
Chlorophorus varius (O. F. MÜLLER 1766)	+++	+++	+++
Chlorophorus sartor (FABRICIUS 1781)	+++	+++	+++
Lamia textor (LINNÉ 1758)	+	+	+
Liopus nebulosus (LINNÉ 1758)	++	++	++
Exocentrus punctipennis (MULSANT 1856)	+++	+++	+++
Mesosa nebulosa (FABRICIUS 1781)	+	+	+
Anaesthetis testacea (FABRICIUS 1781)	++	+++	+
Oberea oculata (LINNÉ 1758)	++	+++	+
Tetrops praeusta (LINNÉ 1758)	+++	+++	++

Table 2. *Rearing and sampling data for the cerambycid species found at Körtvélyes*

? not known ! new data

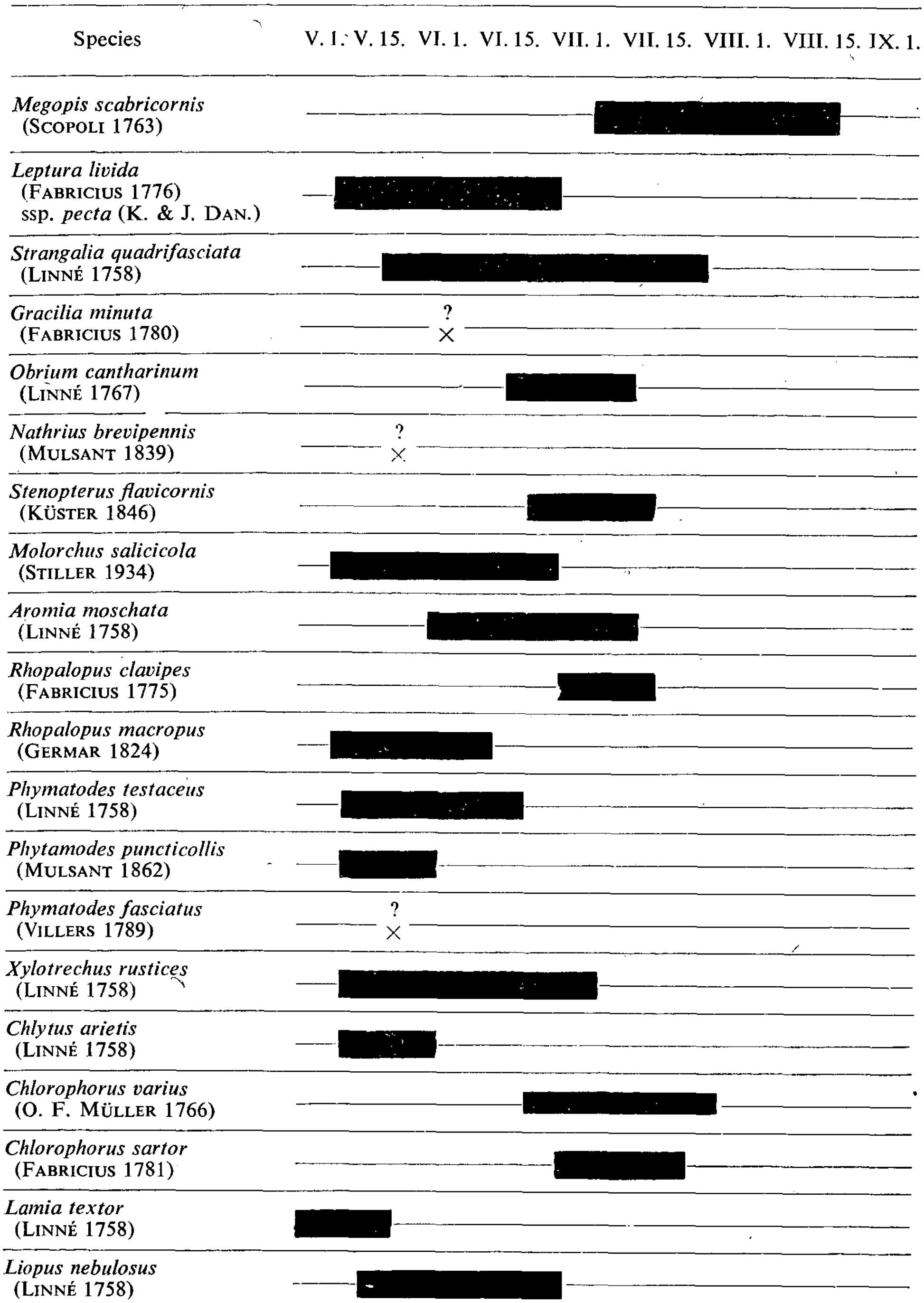
Species	Reared	Identified as larva	Collected from host plant	Attracted to flowers
Megopis scabricornis (SCOPOLI 1763)	–	+	+	–
Leptura livida (FABRICIUS 1776) ssp. *pecta* (K. J. DAN.)	+!	–	–	+
Strangalia quadrifasciata (LINNÉ 1758)	+	–	–	+
Gracilia minuta (FABRICIUS 1780)	–	–	+	?
Obrium cantharinum (LINNÉ 1767)	+	–	+	–
Nathrius brevipennis (MULSANT 1839)	–	–	+	?
Stenopterus flavicornis (KÜSTER 1846)	+!	–	–	+
Molorchus salicicola (STILLER 1934)	+	–	+	–!
Aromia moschata (LINNÉ 1758)	–	–	+	–
Rhopalopus clavipes (FABRICIUS 1775)	+	–	+	–
Rhopalopus macropus (GERMAR 1824)	+!	–	+	–
Phymatodes testaceus (LINNÉ 1758)	+	+	+	–
Phymatodes puncticollis (MULSANT 1862)	+!	–	+!	–!
Phymatodes fasciatus (VILLERS 1789)	+!	–	+	?
Xylotrechus rusticus (LINNÉ 1758)	+	+	+	–
Chlytus arietis (LINNÉ 1758)	+	–	+	+
Chlorophorus varius (O. F. MÜLLER 1766)	+!	–	–	+
Chlorophorus sartor (FABRICIUS 1781)	+!	–	–	+
Lamia textor (LINNÉ 1758)	–	–	+	–
Liopus nebulosus (LINNÉ 1758)	+!	–	+	–
Exocentrus punctipennis (MULSANT 1856)	+!	–	+	–
Mesosa nebulosa (FABRICIUS 1781)	+	–	+	?
Anaesthetis testacea (FABRICIUS 1781)	+	–	+	–
Oberea oculata (LINNÉ 1758)	–	–	+	–
Tetrops praeusta (LINNÉ 1758)	+!	–	+	–

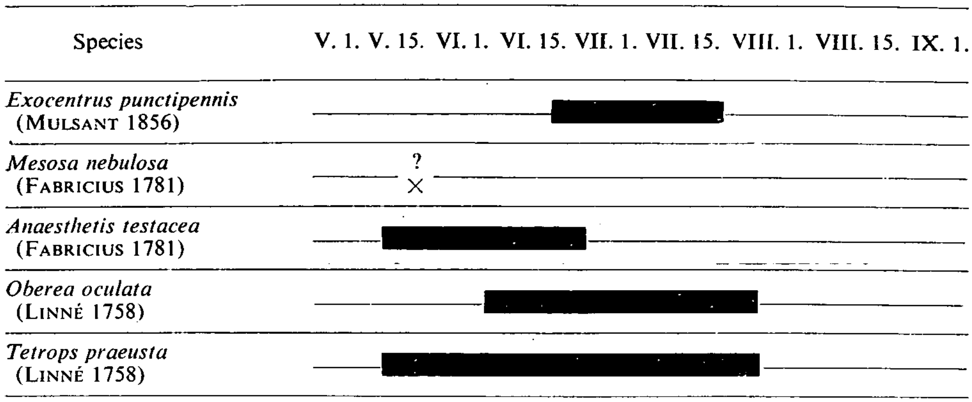
Table 3. *Within-tree sites for cerambycid species in willow*

+ + trunk (diameter exceeds lo cm) + branch (diameter less than lo cm)
? not known ! new data

Species	In decaying wood	In living tree parts	In brushwood heaps and trunks stored otudoors for less than 2 years	In brushwood and trunks with bark, otudoors for more than 2 years
Megopis scabricornis (SCOPOLI 1763)	+ +	–	–	–
Leptura livida (FABRICIUS 1776) ssp. *pecta* (K. J. DAN.	–	–	–	+ !
Strangalia quadrifasciata (LINNÉ 1758)	+ +	–	–	–
Gracilia minuta (FABRICIUS 1780)	–	–	?	–
Obrium cantharinum (LINNÉ 1767)	–	–	+	+
Nathrius brevipennis (MULSANT 1839)	–	–	?	–
Stenopterus flavicornis (KÜSTER 1846)	–	–	–	+ !
Molorchus salicicola (STILLER 1934)	–	–	–	+ !
Aromia moschata (LINNÉ 1758)	–	+ +	–	–
Rhopalopus clavipes (FABRICIUS 1775)	–	–	–	+
Rhopalopus macropus (GERMAR 1824)	–	–	–	+
Phymatodes testaceus (LINNÉ 1758)	–	–	+	+ !
Phymatodes puncticollis (MULSANT 1862)	–	–	–	+ !
Phymatodes fasciatus (VILLERS 1789)	–	–	–	+ !
Xylotrechus rusticus (LINNÉ 1758)	–	–	+ +	–
Chlytus arietis (LINNÉ 1758)	–	–	+	–
Chlórophorus varius (O. F. MÜLLER 1766)	–	–	–	+ !
Chlorophorus sartor (FABRICIUS 1781)	–	–	–	+ !
Lamia textor (LINNÉ 1758)	–	+	–	–
Liopus nebulosus (LINNÉ 1758)	–	–	+	+
Exocentrus punctipennis (MULSANT 1856)	–	–	–	+
Mesosa nebulosa (FABRICIUS 1781)	–	–	–	+
Anaesthetis testacea (FABRICIUS 1781)	–	–	+	+
Oberea oculata (LINNÉ 1758)	–	+	–	–
Tetrops praeusta (LINNÉ 1758)	–	–	+	–

Table 4. *The appearance of adults in cerambycid species found at Körtvélyes*





I was able to contruct a model of swarming based on the data of the period 1974—1980. Swarming time of species developing in brush-woods and which were not attracted to flowers was studied observing brush-wood heaps, the only place of their mass appearance. After being exposed to outdoor conditions, the water content of the brush-woods depends on precipitation. The other key factor in development is the effective heat sum (BÁLINT 1957; GYŐRFI 1957) which also depends on the weather. So the actual patterns might be different from the average figure obtained (Table 4).

Data from the literature (PLAVILTSCHIKOV 1936, 1940, 1958, HEYROVSKY 1955, DEMELT 1966, KASZAB 1971) point to the possibility that some other cerambycid species collected at Körtvélyes develop also on *S. alba*. These species are: *Cerambyx scopolii* (FÜESSL.), *Palgionotus arcutatus* (L.), *Saperda carcharias* (L.) and *S. populnea* (L.).

Leptura livida (FABR.) ssp. *pecta* (K. and J. DAN.) and *Chlorophorus varius* (O. F. MÜLL.) are elements of the foreststeppe fauna (GASKÓ 1979).

Discussion

Most cerambycid beetles species developing on *S. alba* use the brush-wood of the willow 16% of all species (4 species) were reated from flood preventing brush-wood heaps stored outdoors for notm more than 2 years; 2 species (8%) were collected here, too, though I did not manage to rear them. 4 species (16%) were equally abundant in fresh and older brush-wood heaps. 11 species (44%) were obtained from bush-wood older than two years still having its bark. The time period during which the rearing lasted was not included in the calculation of the brush-wood age.

Lamia textor (L.), the only flightless cerambycid beetle species of Körtvélyes was very rare. *A. moschata* invaded living trunks. The *Xylotrechus rusticus* (L.) usually developed in freshly cut or still standing but decaying trunks of *S. alba*. Only a few cerambycid species (2 species) developed in dead trunks or decaying woods. Their numbers were also small. Their share in the community was much less than in a usual forest in the southren lowland (i.e. Mezőhegyes or Ásotthalom).

It is worth mentioning than in the case of species assemblages developing in trees of planted flood plain forests, the life form relations were similar. This was interesting as these cerambycid species had no brush-wood habitats safe from floods as their relatives developing on *S. alba*. It should be mentioned, however, that the twigs in question were mostly safe from inundation.

So it can be stated that especially the species developing for more than one year, the species living in trunks and the flightless species suffered most from the inundations. Their suffered semaphoronts could not stand inundation for long because the wood in which they develop had a greater permeability.

The most sensitive were the non-diapauzing larval stages. It was also important that the young larvae of most species developing in the trunk and for more than one year, were usually found in the bark or just under the bark.

The spring flood coinciding with the swarming time or just preceding it restricted the egg-laying. Since 1970 there were no 2—3 year periods during which development could take place undisturbed. Consequently, even species of flood plain were abundant only occasionally (after some years without inundation) and sporadically (near decaying trunks with hihger stems). When trees were available otuside the dikes, flood plain cerambycid populations often invaded them. The opposite was observed after the floods. I have found that *Megopis scabricornis* (SCOP.) was a polyphagous, *Strangalia quadrifasciata* was an oligophagous species even on population level. The effect of high water level could best be demonstrated by the population decrease of *Saperda carcharias* (L.), a species developing in living trees.

Among the rarest species I should mention *Molorchus salicicola* (STILLER) and *Phymatodes puncticollis* (MULS.).

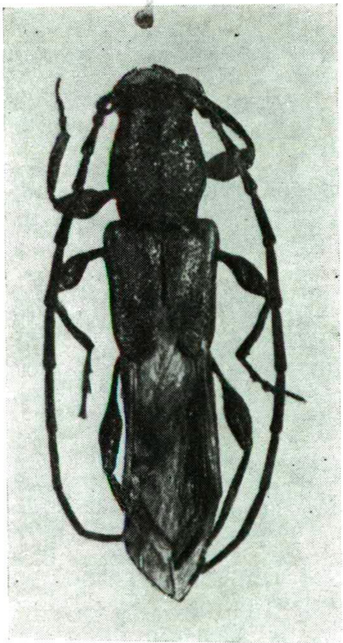


Fig. 1. *Molorchus salicicola* (STILLER) male.

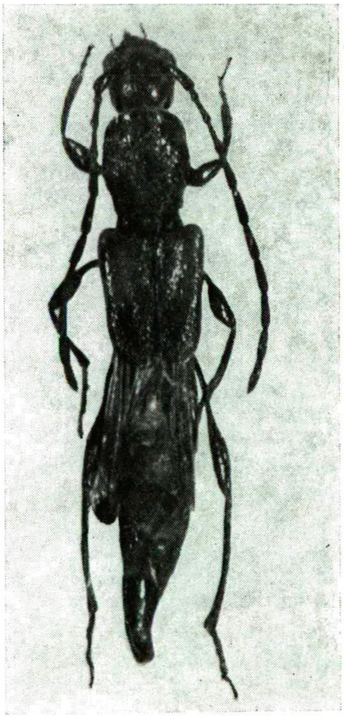


Fig. 2. *Molorchus salicicola* (STILLER) female.

M. salicicola has only been found in the Carpathian Basin. Localities and collectors were: Újszeged, Szeged, Stiller; Bátorliget, KASZAB and SZÉKESSY (1 specimen). I have found the species at Makó, Vetyehát, Szeged-Tápé, Körtvélyes, Mártély, Bokros and Ásotthalom. There was a characteristic sexual dimorphism in the species (on Fig. 1 the male, Fig. 2 the female is shown). *P. puncticollis* had been a parenthetical species before 1974. I found 4 samples collected in the Carpathians and the Carpathian Basin at the Zoological Collection of the Museum of Natural History, Budapest. Their data: Mehádia, collected by PÁVEL; Croatia, WACHSMANN; Ludberg, Apfelbeck; Croatia, Streda. I collected the first greater series of this species in Vetyehát, 5 May 1974 and I have found it at Makó, Körtvélyes, Sasér and Bokros. This ponto-mediterran species should expanding its range; I have found it in some places in great numbers. Otherwise V. STILLER who surveyed brush-wood heaps, stored outdoors, so thoroughly, would have found it

References

ANDÓ, M. (1969): Climatic and microclimatic peculiarities of the Tisza and its inundation area. — Tiscia (Szeged) *5,* 15—37.

BÁLINT, GY. (1957): Védekezés a faanyagok rovarkártevői\ellen (Protection against the wood-pests). — Budapest.

BÉL, M. (1732a): Csanád vármegye leírása (Description of Csanád county). — Manuscript, Szeged.

BÉL, M. (1732b): Csongrád vármegye leírása (Description of Csongrád county). — Manuscript, Szeged.

BODNÁR, B. (1939): A hódmezővásárhelyi református gimnázium természetrajzi múzeumának a története (History of the Museum of Natural History of the Cal. secondary School of Hódmezővásárhely). — Spec. edit., Hódmezővásárhely.

BODROGKÖZY, GY. (1966): Die Vegetation des Theiss-Wallenraumes III. Auf der Schutzdammstrecke zu Szeged durchgeführten fitozönologischen Analysen und ihre praktische Bewertung. — Tiscia (Szeged) *2,* 47—67.

CSIKI, E. (1906): Csongrád vármegye bogárfaunája. — A magyar orvosok és természetvizsgálók 1905. évi 33. vándorgyűlésének munkálatai (The insect-fauna of Csongrád county. Works of the 33. annual meetings of Hungarian doctors and naturalists of 1905). — Spec. edit., Budapest.

DEMELT, C. (1966): Bockkäfer oder Cerambycidae. I. Biologie mitteleuropäischer Bockkäfer (Col. Cerambycidae) unter besonderer Berücksichtigung der Larven. — Die Tierwelt Deutschlands *52,* Jena.

ERDŐS, J. (1935): Maros torkolatának árvízi és ártéri bogárvilága biológiai szempontból (The flooding and floodplain insect-fauna of the area of Maros-mouth from biological viewpoint). — Dokt. ért. (Doct. diss.) Szeged.

GASKÓ, B. (1979): Adatok a Szeged körtöltés melletti erdősáv Cerambycida faunájához (Data to the Cerambycidae-fauna of the forestbilt along Szeged-dike). — Móra F. Múz. Évk. (Under imprint).

GILJAROV, M. S. (1954): Vid, populacija i biocenoz. — Zool. Zsurn. *33,* 769—779.

GYŐRFI, J. (1957): Erdészeti rovartan (Forestical entomology). — Budapest.

HEYROVSKY, L. (1955): Tesarikoviti-Cerambycidae. — Fauna CsR. Praha.

JERMY, T. (1972): A növényevő rovarok táplálék specializációjának etológiája (Fitofag insects' nutritive specification). — (Doct diss.) Budapest.

KASZAB, Z. (1971): Cincérek (Cerambycidae). Long horned beetles-Cerambycidae. — Fauna Hung. *10,* Budapest.

MEDVEGY, M. (1979): Észrevételek egy cincérgyűjtemény rendezése során (Observations arranging a collection of long horned beetles). — A Veszprém M. Múz. Közl. *14,* 226.

PLAVILTSCHIKOV, N. N. (1936): Naszekomye, Zsesztkokrylye. — Fauna SzSzSzR, Moszkva—Leningrád.

PLAVILTSCHIKOV, N. N. (1940): Naszekomye, Zsesztkokrylye. — Fauna SzSzSzR. Moszkva—Leningrád.

PLAVILTSCHIKOV, N. N. (1958): Zsesztkokrylye. — Fauna SzSzSzR. Moszkva—Leningrád.
STILLER, V. (1926): Die Käferfauna der Umgebung von Szeged in Ungarn, und Beschreibung einer neuen Farbenaberation von Limonius aeruginosus Oliv. (Col.). — Deutsche Entomologische Zeitschrift. *4*, 149—157.
STILLER, V. (1934): Eine neue Art der Gattung Caenoptera Thoms. aus Ungarn (Col. Ceramb.). — Mitteilungen der Deutschen Entomologischen Gesellschaft *5*, 37—39.
STILLER, V. (1935): Beobachtungen über Caenoptera salicicola Stiller an der Heimstätte. (Col. Ceramb.) — Entomologischer Anzeiger *15*, 41—44.
STILLER, GY. (1939): Kiegészítő adatok Csongrád vármegye bogár-faunájához (Additions to the insect-fauna of Csongrád county). — Acta Biol. Univ. Szeged, *5*, 41—53.
TIMÁR, L. (1953): A Tisza mente Szolnok és Szeged közti szakaszának növényföldrajza (Plantgeography of Tisza embankment between the towns Szolnok and Szeged). — Földr. Ért. *2*, 87—113.
UHERKOVICH, G. (1971): A Tisza lebegő paránynövényei (A Tisza fitoszesztonja) (Floating microplants of river Tisza) (The fitoseston of river Tisza). — Szolnok.
VÁNKY, J.—VELLAY, I. (1894): Adatok Szeged vidékének állatvilágához (Data of the fauna of Szeged s county). — Spec. edit. Szeged.

Salix alba tápnövényű Cerambycidák Körtvélyes szigeten

B. GASKÓ

Móra Ferenc Múzeum Szeged, Magyarország

Kivonat

A hullámtér jellegű Körtvélyes sziget Salix alba tápnövényű Cerambicidáinak felmérése 1974-től 1980-ig tartott. A tápnövény meghatározásának az alapja a kinevelés volt. Néhány több éves kifejlődésű fajnál az azonosítást célszerűbbnek látszott a lárvák alapján elvégezni. Monofág fajok és kártevők meghatározásánál elegendő adat a tápnövényről való gyűjtés is Körtvélyesszigeten 25 Salix alba tápnövényű Cerambycida került elő. Ezek zömmel (84%-ban fűzfarőzsében kifejlődő fajok. Jólehet a xilofág cincérek, fejlődésük kritikus lárvális és puppális szakaszában védettek az áradások vizéről, de ez a védelem korántsem tekinthető teljesnek. Különösen az elhalt törzseken élő több éves fejlődésmenetű és az röpképtelen Cerambycidákat szelektálják az áradások (részarányuk 8% illetve 4%).

A Salix alba fitoncidjai bizonyos fajoknak kizáró tényezőt jelentenek. Ezért egy nagyobb kiterjedésű, monoton fajösszetételű Salix alba állomány a telepített egyéb erdőket is védi.

Cerambicidae sa hraniteljki Salix alba na ostrvu Körtvélyes

GASKÓ B.

Móra Ferenc Muzej, Szeged, Hungaria

Abstrakt

Istraživanja Cerambicidae sa hraniteljki Salix alba na, plavnom ostrvu Körtvélyes, vršena su u periodu 1974—1980 godine. Odredjivanje biljki hraniteljki vršeno je na bazi odgoja. Za nekonko vrsta, čiji razvoj traje više godina, celishodnije je identifikaciju vršiti preko larava. Determiliacija monofaga i štetnih vrsta vršeno je na bazi sakupljanja sa biljki hraniteljki. Sa ostrva Körtvélyes ukupno je prikupljeno 25 vrsta Cerambicidae sa hraniteljki Salix alba. Velika večina njih (84%) se razvija u fašinama vrbe. lako su ksilofage strižibube u svojim kritišnim stadijumima razvoja larvi i eklozije zaštičene od poplava, ipak je ova zaštita nepotpuna. Poplave vrše selekciju 8% (4%) Cerambicidae koji žive na trupcima, nemaju sposobnost letenje, čiji razvoj traje više godina.

Fitoncidi Salix alba za odredjene vrste Cerambicidae predstavljaju eliminatorni faktor. Usled toga se jedna poveća čista sastojina Salix alba javlja sa svojom zaštitnom ulogom i na druge plantažne šume.

БЕЛАЯ ИВА КАК ИСТОЧНИК ПИЩИ УСАЧЕЙ ОСТРОВА КЕРТВЕЛЬЕШ

Б. Гашко

Музей им. Ференца Мора, Сегед, Венгрия

Резюме

Изучение ивы белой как источника пищи усачей, провели на разливной территории острова Кертвельеш, с 1974 года по 1980 г. Основанием для определения этих растений послужили экспериментальные исследования. Идентификацию с отдельными многолетними развимыми видами усачей проводили с личинками. При определении монофагов и вредителей, достаточным явилась их заготовка с пищевого растения. На острове Кертвельеш удалось собрать 25 усачей, питающихся на белой ивы. Основная их масса (84%) относится к видам, которы развиваются в ивовой роще. В целом усачи ксилофаги, в критической, личинковой и кукольной стадиях защищены от наводнений. Однако эта защита далеко неполная. Особенно же у нелетающих усачей, развивающихся на гнилых стволах, что при наводнениях приводит к значительной гибели их (8%, 4%).

Фитанциды белой ивы для отдельных видов усачей являются хорошими стимуляторами развития. В связи с этим, один крупный лес монотипичной с белой ивы, может защитить и другие леса.

Tiscia (Szeged) Vol. XVII, pp. 155—162 (1982)

FLOOD AS AN ECOLOGICAL PERTURBATION OF EPIGEIC ANIMAL COMMUNITIES. I. SOME PRELIMINARY HYPOTHESES ON THE APPLICATION OF CATASTROPHE THEORY BY EVALUATING SOME MÁRTÉLY—KÖRTVÉLYES DATA

L. GALLÉ, GY. GYÖRFFY and ELIZABETH H. HORNUNG

Zoological Department of Attila József University, Szeged
(Received 24 July, 1981)

Abstract

Catastrophe theory seems to be a useful model to study the ecological consequences of flood. The speed of inundation, the size of flooded areas and the time span of flood are important in the formation of jumps of fold catastrophes, size of hysteresis and the time relations of jumps. The possibilities of cusp catastrophe are determined by the number of refuge places.

Recolonization from outer areas consists of two steps: (a) in the immigration phase the increase of size of the initial population is saturation-type and (b) in the multiplication phase it is logistic. The possibilities and proportions of these two steps depend on the migration ability of recolonizing populations and the multiplication strategies of their propagula.

Introduction

The main difficulties in animal ecological investigations of the flood area o River Tisza derive from the floods taking place in every year. The effect of flood is an ecological perturbation that prevents the development of near-to-climax states, structurally constant animal communities and well defined trophic-energetic systems. This means that the methods usually applied to study ecosystems are not sufficient to investigate the structure and energetics of flood area communities. According to above mentioned the results of the ecological investigations have been made in the flood area cannot be generalized in space and time because they refer to different phases of ecological succession after perturbations.

There are several works concerning the effects of flood in the literature of Tisza research but only few authors have investigated the problems of recolonization after floods from quantitative respects. GALLÉ (1972) documented the influence of inundation on the density of ant populations. The effect of flood was also investigated on the structure and productivity of plant communities by BODROGKÖZY and HORVÁTH (1979) and on the recolonizations of Apoidea populations by TANÁCS (1979).

The aim of present work is to give some *a priori* hypotheses on the influence of flood on the structure of animal communities using some known data. Our two basic topics are: 1. role of inundation in the structure of communities and the relevant properties of the succession after flooding; 2. the phases of immigration and recolonization after flooding.

Effects of flood on the community structure

Calculating diversity values from the data of Bodrogközy and Horváth (1979) and Tanács (1979) by the well known Shannon function it can be seen that the diversity is a good indicator of the changes taking place in the structure after flood (Fig. 1, 2). Diversity increases just after flooding and at the end of the season decreases, from phenological reasons.

To investigate the influence of flood on the diversity of communities we apply one of the relatively new results of mathematical topology, the catastrophe theory (Thom 1969). Catastrophe theory has been widely used in biology, especially in embriogenesis and developmental biology, and also in the modelling of nerve impulses (Woodcock 1977). In ecology it has been used for *Choristoneura* — forest system (Jones 1977)

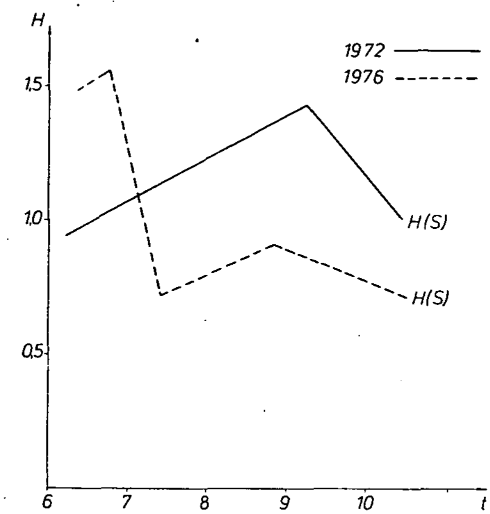


Fig. 1. Changes in divesity of plant communities after flood on the basis of Bodrogközy's and Horváth's data (1979).

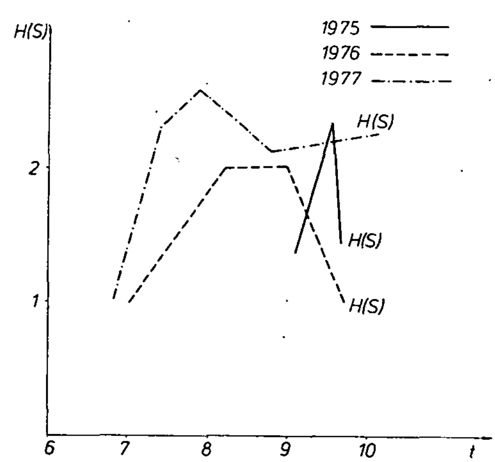


Fig. 2. Changes in diversity of Apoidea community during regeneration after flood, calculated from Tanács's (1979) data.

and dutch elm desease (JEFFERS 1978). In its original form this theory investigates the behaviour of the dynamics systems in terms of the maxima and minima of the assiciated potential energy function. Minima represent stationary or (quasi-) equilibrium states in ecological systems and they are attractants while instable points corresponding to maxima are repellents (JONES 1977). For the study of the influence of flood a starting point can be a system where two attractive and one repellent points can be found (Fig. 3). This very simple two component system (e.g. a primitive com-

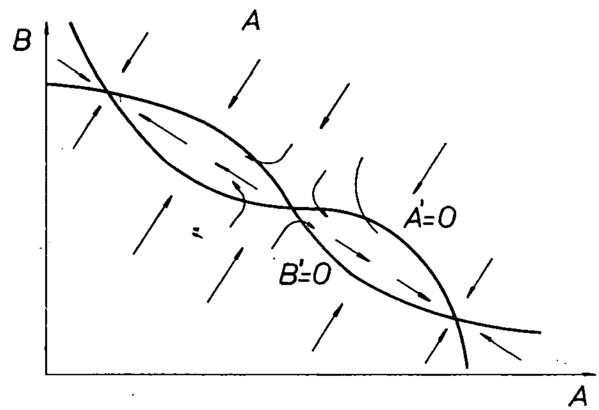


Fig. 3. A simple two component system with one repellent and two attractive points.

petitive phase plain or a cenosystem consisting of two populations) satisfies the bimodality criteria of catastrophe theory. The transition from one stabil state to the other meets the criterium of dicontinuity ("catastrophe"). In the application for the flood

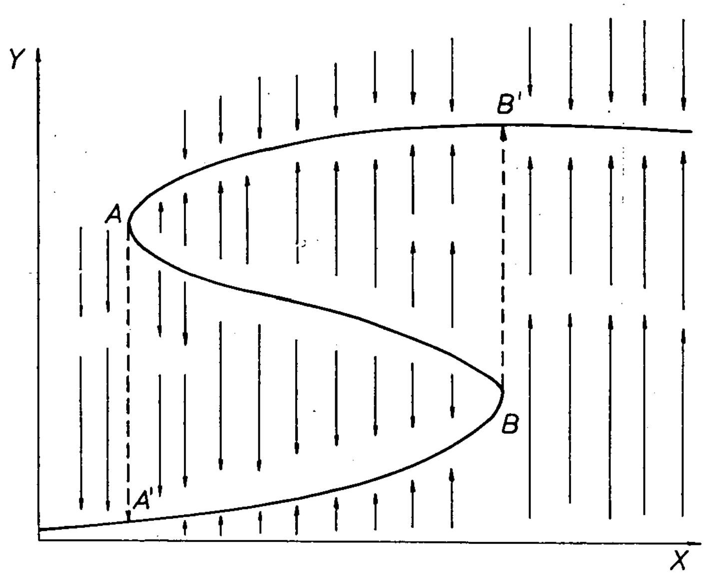


Fig. 4. Hysteresis in a simple fold model of the function between height of flood (x) and the diversity of epigeic animal community.

effect hysteresis is represented by the delayed reaction scheme of the recolonization of the community (Fig. 4): at a given height the water floods the majority of flood areas and killes almost all animals. Surviving individuals concentrate into certain "refuge places" i.e. small dunes, hills, tree trunks etc. As a consequence of flooding such strata that have been transitional refuge places (grass layers, bushes etc.) the level of water has to decrease under the value x corresponding point "B", to the x value of point "A" to let radiation start from refuge places. As a result of this, average diversity (H) increases in the whole area. It is obvious that both the number of refuge places and their ratio to the whole or the flooded area are important: the absence or very small proportion of refuge places don't make a rapid after-flood radiation possible and $\overline{AA'}$ jumping return is prevented. In this case the recolonization is a slow process by immigration from outer areas and it corresponds to the smooth return in simple cusp. Such a "cusp" scheme is shown in Fig. 5 where $\frac{t}{r} = z$ is the whole area/refuge places ratio, x is the height of the flood and H is the average diversity of the community.

The time span of the inundation is also an important factor. In long lasting water coverage a "refuge place succession" takes place and there are strong selective me-

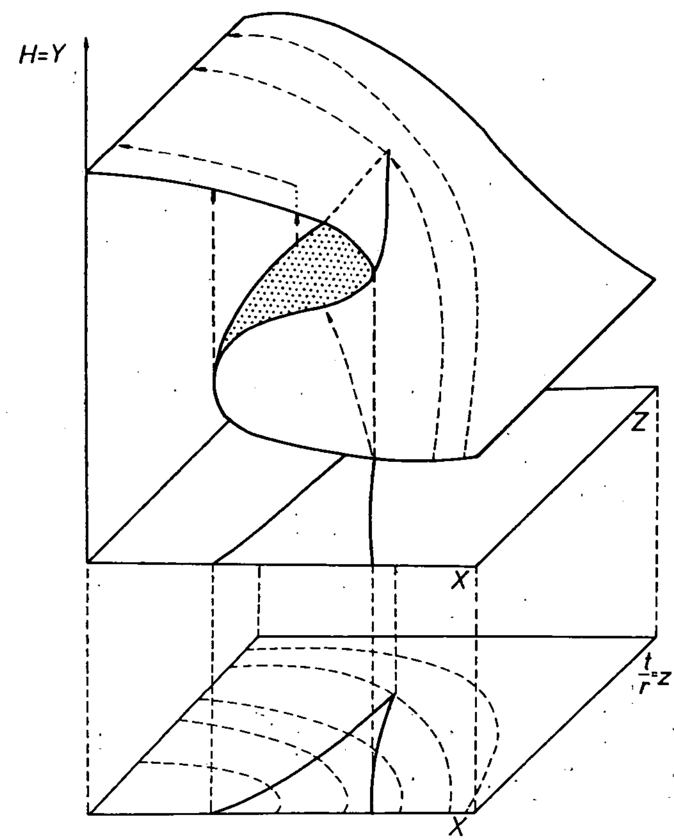


Fig. 5. Cusp catastrophe in the relation of flood height (x); whole area/flood area ratio (z) and diversity.

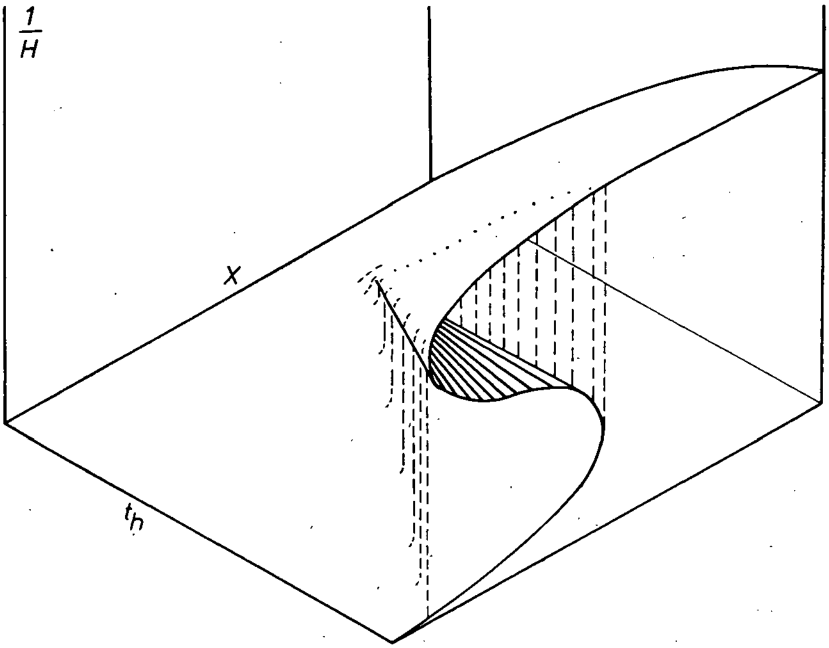


Fig. 6. The effect of height and time span (t_H) of inundations on diversity.

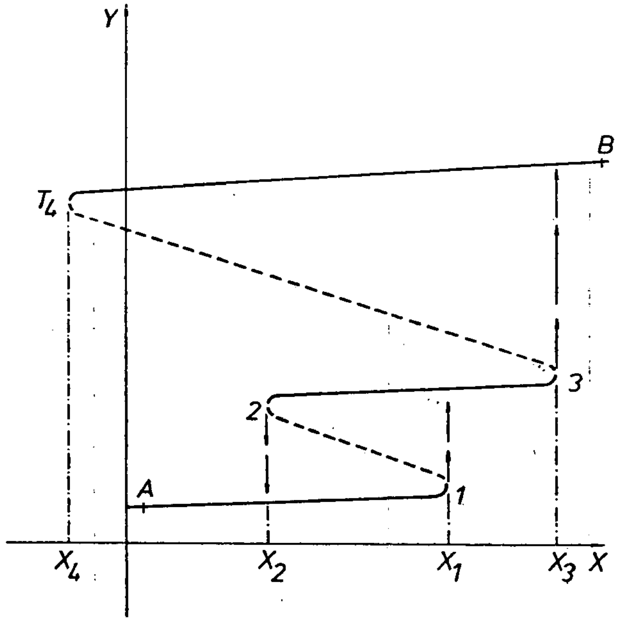


Fig. 7. Supposed behaviour of a structural property of an ecological system as a consequence of perturbations of different intensity (x).

chanisms in it. This selection results a decrease in the diversity of communities in refuge places. In this case diversity can't return to its original value by rapid radiation from refuge places after inundation and a smooth return pattern takes place by immigration (Fig. 6).

Two properties of ecological perturbations can be established on the basis of fold catastrophe (as for 1. see also JONES 1977):

1. Perturbation have to be reduced to a value x_2 much less than the threshold x_1 at which community structure was dramatically changed, to ensure the system to return into its original state (Fig. 7).

2. A second threshold can take place from where there is no return in positive ranges, and for this reason it is an irreversible perturbation that gets the system in that state (x_3 and x_4 in Fig. 7).

Properties of recolinization

Present work deals with two types of recolonizations:

1. Radiation: a rapid distrubution of populations from refuge palces without multiplication phase.

2. Immigration: slow process from outer areas. On the basis of a model got on ant populations (Gallé, unpublished), there are two phases of this type (Fig. 8): (a) sensu stricto immigration, when population increase is a saturation-type function of time:

$$\frac{dN}{dt} = a - bN(t)$$

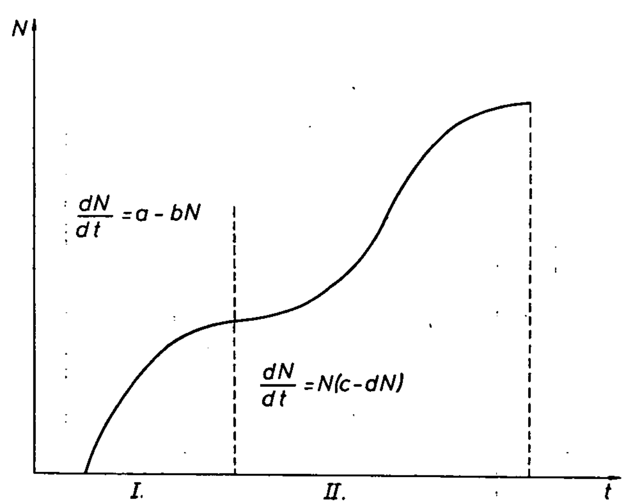


Fig. 8. Two steps of recolonization after floding.

where N is the size of population; and (b) multiplication phase when multiplication is the most important factor in population growth. In this phase population growth follows a logistic function:

$$\frac{dN}{dt} = N(t)[c - gN(t)].$$

The possibilities and proportions of these two steps depend upon migration ability of populations and ecological strategies of their propagula.

References

BODROGKÖZY, GY. and HORVÁTH, I. (1979): Effect of lasting floods on the species composition and organic matter production of the marshy-meadow lands in the flood plains of the Tisza. — Tiscia (Szeged) *14*, 81—88.

GALLÉ, L. (1972): Formicoidea populations of the ecosystems in the environs of Tiszafüred. — Tiscia (Szeged) *7*, 59—68.

JEFFERS, J. N. R. (1978): An introduction to systems analysis: with ecological applications. — London, Arnold.

JONES, D. D. (1977): Catastrophe theory applied to ecological systems. — Simulation, July, 1977, 1—15.

TANÁCS, L. (1979): Regeneration of the Apoidea insect fauna in the flood area, as a function of ecological conditions. — Tiscia (Szeged) *14*, 175—186.

THOM, R. (1969): Topological models in biology. — Topology *8*, 313—335.

WOODCOCK, A. E. R. (1977): Catastrophe theory and the modelling of biological systems. — Lecture Notes in Biomathematics *18*, 342—385.

Az árhullám, mint az epigéikus állatközösségek ökológiai perturbációja. I. Néhány előzetes hipotézis a katasztrófa elmélet alkalmazásáról, Mártély—Körtvélyesi adatok alapján

GALLÉ L., GYÖRFFY GY. és H. HORNUNG ERZSÉBET

József Attila Tudományegyetem Állattani Tanszék, Szeged, Magyarország

Kivonat

A tiszakutatás irodalmában igen kevés olyan adat szerepel, amely az árvizeknek az epigéikus állatpopulációk struktúrájára gyakorolt kvantitatív hatására vonatkozik. Ezért a szerzők ezen adatok alapján valószínűsíthető feltevései a priori és munkahipotézis jellegűek: 1. Az árvizek ökológiai konzekvenciáinak tanulmányozására alkalmas modell a katasztrófa elmélet. A fold katasztrófa ugrásainak kialakulásában, a hiszterézis nagyságában, az ugrások idő-relációiban az elöntés sebessége, az elöntött területek nagysága és az árvíz időtartama játszik fontos szerepet. A cusp típusú katasztrófa kialakulásának lehetőségeit viszont a refugiumok száma határozza meg. 2. A külső területekről történő rekolonizáció két lépésű: a) Az immigrációs fázisban az iniciális populáció nagysága szaturációs; b) amultiplikációs fázisban pedig logisztikus növekedésű. E két lépés alakulásának lehetőségei és egymáshoz viszonyított aránya az újratelepülő populációk migrációs hajlamának, valamint propagulumaik szaporodási stratégiájának függvényei.

Poplava kao ekolo ka perturbacija epigejskih zoocezona. I. Nekoliko prethodnih hipoteza primene teorija katastrofa na osnovu podataka Mértély—Körtvélyes

GALLÉ L., GYÖRFFY GY. i H HORNUNG ERZSÉBET

JATE, Állattani Tanszék, Szeged, Hungaria

Abstrakt

O uticaju poplava na strukturalne odlike epigejskih životinjskih populacija u kvantitativnom pogledu, postoji veoma mali broj podataka u literaturi o istraživanjima reke Tise. Zbog toga, moguće pretpostavke autora, na osnovu tih podataka, su a priori i radnohipotetičnog karaktera:

1. Teorija katastrofa se pojavljuje kap pogodan model za izučavanje ekoloških posledica poplava. U odnosu na skokovite katastrofe, veličinu histereze u razvitku Zemplje, na vremenske relacije katastrofa, značajnu ulogu igra intenzitet poplave, veličina poplavljenog proručja i vreme trajanje poplave. Mogućnosti pojave katastrofe tipa cups pak su odredjeni brojem refugijuma.

2. Rekolonizacija sa okolnih površina je dvojaka:

(a) u fazi imigracije veličine inicijalne populacije je saturacijalna,

(b) u fazi multiplikacije pokazuje logistički razvoj.

Mogućnosti i medjusobni odnos razvoja ove faze su funkcije migratornih sklonosti kolonističkih populacija i strategije njihovih propaguluma razmnožavanja.

НАВОДНЕНИЯ, КАК ПОВЕРХНОСТНАЯ ЭКОЛОГИЧЕСКАЯ ПЕРЕТУРБАЦИЯ ВЗАИМНЫХ ОТНОШЕНИЙ ЖИВОТНЫХ

ё. Отдельные предварительные гипотезы на основании данных Мартей Кёртвейеш по применению теории катастрофы

Л. Галле, Д. Дьерфи и Э. Хорнунг

Университет им. Йожефа Аттилы, кафедра зоологии, Сегед, Венгрия

Резюме

В литературных источниках мало проводится данных, которые были бы относены к квантитативному влиянию наводнений на поверхностную структуру популяции животного мира. В связи с этим, авторы на основании приведенных данных по вероятности постановки вопроса, носящего характер приоритета и рабочего предположения: I. Для изучения экологической последовательности наводнений подходящая моделью является теория катастрофы. В формировании скачков земных катастроф, длительности времени отдельных штампов важную роль играют скорость заливания, величина залитой территории и длительность наводнения. Возникновение катастроф типа «куст» определяет количество рефугимов.

2. Из внешних площадей реколонизация проходит в двух фазах: а) В иммиграционной фазе величина инициативной популяции сатуральная; б) В мултипликационной фазе рост логистический.

Возможность образования двух фаз и взаимных отношений, является результатом образования нововозникших миграционных популяций, а также стратегии размножения пропагулумов.

Tiscia (Szeged) Vol. XVII, pp. 163—166 (1982)

DATA TO THE KNOWLEDGE OF LEPIDOPTERA FAUNA AT MÁRTÉLY—KÖRTVÉLYES ENVIRONMENT PROTECTION AREA. I

S. T. KOVÁCS

Commitee of Tisza-research, Szeged
(Received September 15, 1981)

Abstract

The paper contains the check list of Macrolepidoptera species collected with light-traps functioning with 250 W mercury vapour lamp in Mártély in 1971, with 125 W mercury vapour lamp in Körtvélyes in 1979/80, the species collected with Malaise-trap operating seriatim set up on the meadow of Körtvélyes holm and those collected with day-netting and special candling (Maxim, propane-butane lamp) in this area with quantitative data giving full systematical particulars. It indicates the occurrence of Gortyna borelii lunata Pierret (Hydroecia leucographa Bkh.) in Mártély and it contains the short review of some typical and atypical species on the basis of their ecological and zoogeographical affiliation.

Introduction

Altough flora and fauna of Mártély—Körtvélyes environment protection area have been examined by many research workers but during the last 10 years these investigations have been accelerating and widening out. Specialists of numerous groups put to press their results of research and observations but lepidopterological work hasn't been published yet from this area.

The examined area

The examined area consists of two holms wich are bordered by living Tisza and its dead arms. Once a year it is generally covered by water. Its flora is hygrophylic. On the higher relief of Mártély there are canadian poplars *(Populus canadensis)* meadows with *Chrysanthemum serotinum, Lythrum salicaria* and *Symphytum officinale.* Fen windows with reed-grass change with patches of sedge *(Thyphoidetum arundinaceae)* (GY. CSONGOR, by word of mouth). Körtvélyes is white willow gallery with *Urtica urens, Rubus idaeus, Lythrum* and *Iris pseudacorus* in it. Among the trees of the gallery *Fraxinus americana* and *Amorpha fruticosa* can be found (GY. CSONGOR, by word of mouth). The plant-community of flood-plain meadow — where the Malais-trap was standing — was marsh-meadow rich in species *(Alopecuretum pratensis; Carici-Thyphoidetum arundinaceae; Glycerietum maximae)* (ANDÓ—BODROGKÖZY—MARIÁN 1974).

Table 1. *The author applied to the denomination of species the names of Boursin-system*

Species	Mártély	Körtvélyes
Hepialidae:		
Hepialus sylvina L.	—	18
Cossiidae:		
Cossus cossus L.	4	7
Zuezera pyrina L.	3	—
Phragmataecia castaneae HBN.	15	12
Geometridae:		
Chlorissa viridata L.	11	8
Euchloris smaragdaria F.	10	18
Thalera fimbrialis SCOP.	18	13
Rhodostrophia vibicaria CL.	7	—
Aplasta ononaria FUESSLI	—	2
Calothysanis amata L.	9	11
Scopula immorata L.	—	20
Scopula rubiginata HUFN.	4	8
Scopula immutata L.	7	4
Scopula corrivalaria KRETSCHM.	10	—
Scopula flaccidaria Z.	6	—
Scopula ternata SCHRK.	—	1
Sterrha rusticata SCHIFF.	5	—
Sterrha muricata HUFN.	10	8
Sterrha dimiata HUFN.	5	—
Sterrha seriata SCHRK.	4	—
Sterrha fuscovenosa GOEZE	2	—
Sterrha nitidata H.	10	—
Sterrha aversata L.	16	4
Sterrha sericeata HBN.	4	5
Lythria purpuraria L.	3	—
Mesotype virgata HUFN.	6	—
Lithostege farinata HUFN.	7	2
Lithostege griseata SCHIFF.	8	—
Philereme vetulata SCHIFF.	2	—
Xanthorhoe fluctuata L.	6	—
Xanthorhoe ferrugata CL.	16	8
Nycterosea obstipata F.	—	2
Euphya rubidata SCHIFF.	3	—
Mesoleuca albicillata L.	—	1
Epirrhoe alterbata MÜLL.	2	6
Pelurga comitata L.	15	—
Eupithecia centaureata SCHIFF.	13	7
Eupithecia absinthiata CL.	—	2
Lomaspilis marginata L.	14	39
Lomographa dilectaria HBN.	—	4
Bapta bimaculata F.	2	—
Cabera exanthenata SCOP.	2	3
Ennomos autumnaria WERNB.	3	7
Ennomos fuscantaria STPH.	—	2
Selenia lunaria SCHIFF.	5	5
Epione repandaria HUFN.	3	7
Eilicrinia cordiaria HBN.	—	16
Macaria alterbaria HBN.	10	15
Chiasmia clahrata L.	28	37
Tephrina murinaria SCHIFF.	—	9
Tephrina arenacearia SCHIFF.	3	49
Lycia hirtaria CL.	1	3
Biston stratarius HUFN.	—	1
Peribatodes rhomboidaria SCHIFF.	15	—

Species	Mártély	Körtvélyes
Serraca punctinalis Scop.	7	—
Ascotis selenaria Schiff.	14	10
Ectropis bistortata Goeze	16	—
Ematurga atomaria L.	11	—
Noctuidae:		
Chytolitha cribrumalis Hbn.	—	4
Zanclognatha lunaris Sc.	7	—
Rivula sericealis Sc.	16	60
Ectypa glyphica L.	8	—
Aedia funesta Esp.	2	2
Catocala elocata Esp.	1	—
Catocala electa View.	—	3
Scoliopteryx libatrix L.	2	—
Plusia chrysitis L.	2	17
Macdunnoughia confusa Stph.	4	—
Chrysaspidia festucae L.	3	—
Autographa gamma L.	8	6
Abrostola trigemina Wernb.	—	3
Bena prasinana L.	—	2
Earias clorana L.	4	11
Nycteola asiatica Krul.	—	3
Tarache luctuosa Esp.	28	27
Emmelia trabealis Sc.	40	39
Eustrotia bankiana F.	7	—
Eustrotia candidula Schiff.	20	8
Eustrotia uncula Cl.	—	4
Jaspidia pygarga Hufn.	—	13
Porphyrinia purpurina Schiff.	16	—
Axylia putris L.	14	47
Periphanes delphinii L.	3	—
Pyrrhia umbra Hufn.	7	—
Chloridea viriplaca Hufn.	4	3
Chloridea maritima Grasl.	8	—
Athetis furvula Hbn.	46	10
Athetis gluteosa Tr.	15	8
Athetis lepigone Möschl.	13	6
Caradrina morpheus Hufn.	7	10
Caradrina clavipalpis Scop.	—	4
Meristis trigrammica Hufn.	3	—
Archanara sparganii Esp.	—	5
Archanara cannae Esp.	—	2
Celaena leucostigma Hbn.	1	4
Calamia tridens Hufn.	3	—
Gortyna borelii Pierr.	2	—
Hydraecia micacea Esp.	—	5
Luperina testacea Schiff.	9	2
Oligia latruncula Schiff.	2	—
Apamea sordens Hufn.	1	—
Cosmia pyralina Schiff.	—	2
Cosmia trapesina L.	3	—
Ipimorpha retusa L.	—	1
Ipimorpha subtusa Schiff.	—	2
Eucarta virgo Tr.	4	—
Eucarta amethystina Hbn.	—	9
Phlogophora meticulosa L.	—	4
Trachea atriplicis L.	3	—
Dipterygia scabriuscula L.	—	1
Apatele rumicis L.	17	4
Apatele tridens Schiff.	—	5

Species	Mártély	Körtvélyes
Apatele megacephala SCHIFF.	—	3
Symira albovenosa GOEZE	2	1
Atethmia centrago HAW.	—	1
Agrochola lychnidis SCHIFF.	5	—
Xylena vetusta HBN.	2	—
Aporophyla lutulenta SCHIFF.	—	7
Derthisa glaucina ESP.	—	2
Calophasia casta BKH.	—	4
Calophasia lunula HUFN.	2	—
Cucullia chamomillae SCHIFF.	—	1
Senta flammea CURT.	7	—
Mythimna obsoleta HBN.	4	5
Mythimna l-album L.	8	10
Mythimna vitellina HBN.	—	9
Mythimna albipuncta SCHIFF.	4	12
Mythimna conigera SCHIFF.	9	—
Mythimna turca L.	7	16
Mythimna pallens L.	32	24
Monima incerta L.	17	6
Orthosia gothica L.	17	—
Orthosia munda SCHIFF.	14	—
Hyssia cavernosa EV.	4	4
Xylomiges conspicillaris L.	45	—
Panolis flammea SCHIFF.	5	—
Tholera decimalis PODA	16	15
Tholera cespitis SCHIFF.	24	11
Hadena luteago SCHIFF.	4	7
Mamestra dysodea SCHIFF.	1	—
Mamestra aliena HBN.	27	14
Mamestra suasa HBN.	12	—
Mamestra thalassina HUFN.	7	—
Mamestra brassicae L.	9	8
Mamestra oleracea L.	14	10
Polia nebulosa HUFN.	1	—
Discestra dianthi TAUSCH.	3	—
Discestra trifolii HUFN.	14	11
Cerastis rubricosa SCHIFF.	2	3
Amathes c-nigrum L.	32	48
Peridroma saucia HBN.	8	—
Noctua fimbrialis SCHREB.	3	7
Noctua pronuba L.	2	8
Ochropleura plecta L.	3	14
Scotia ipsilon HUFN.	2	—
Scotia exclamationis L.	29	39
Scotia segetum SCHIFF.	62	13
Scotia vestigialis HUFN.	7	10
Euxoa aquilina SCHIFF.	17	15
Euxoa obelisca SCHIFF.	2	—
Nolidae:		
Nola cuculatella L.	2	1
Roeselia albula SCHIFF.	8	12
Celama centonalis HBN.	—	7
Lymantriidae:		
Dasychira pudibunda L.	9	—
Orgyia antiqua L.	4	—
Laelia coenosa HBN.	11	14
Leucoma salicis L.	7	3

Species	Mártély	Körtvélyes
Arctiidae:		
Lythosia quadra L.	4	10
Pelosia muscerda HUFN.	1	27
Ocnogyna parasita HBN.	11	—
Phragmatobia fuliginosa L.	29	33
Spilosoma lubriciperda L.	1	6
Spilosoma menthastri ESP.	18	12
Spilosoma urticae ESP.	8	6
Hyphantria cunea DRURY	26	47
Diacrisia sannio L.	3	—
Ctenuchidae:		
Dysauxes ancilla L.	1	—
Notodontidae:		
Cerura erninea ESP.	—	2
Gluphisia crenata ESP.	—	6
Notodonta ziczac L.	2	—
Notodonta phoebe SIEB.	3	—
Pterostoma palpinum CL.	5	8
Phalera bucephala L.	—	1
Clostera anastomosis L.	—	4
Clostera curtula L.	—	1
Clostera pigra L.	3	1
Sphingidae:		
Herse convolvuli L.	1	2
Celerio euphorbiae L.	4	4
Smerinthus ocellata L.	6	2
Amorpha populi L.	3	8
Pergesa elpenor L.	—	2
Pergesa porcellus L.	—	9
Macroglossum stellatarum L.	—	3
Thyatiridae:		
Habrosyne pyritoides HUFN.	—	2
Tethea or F.	7	3
Drepanidae:		
Cilix glaucata SCOP.	2	—
Lasiocampidae:		
Malacosoma neustria L.	7	—
Macrothylacia rubi L.	9	—
Gastropacha quercifolia L.	2	1
Gastropacha populifolia ESP.	1	15
Odonestis pruni L.	1	1
Hespariidae:		
Carcharodus alceae ESP.		3
Ochlodes venatus BREM.		10
Pieridae:		
Leptidea sinapis L.		3
Colias croceus FOURC.		14
Colias hyale L.		4
Pontia daplicide L.		12
Pieris napi L.		7

Species	Mártely	Körtvélyes
Papilionidae:		
Iphiclides podalirius L.		2
Lycaenidae:		
Thersamonia thersamon HAW.		3
Everes argiades PALL.		12
Glaucopsyche alexis PODA		3
Plebejus argus L.		17
Polyommatus icarus ROTT.		11
Cyaniris semiargus ROTT.		2
Lysandra bellargus ROTT.		1
Nymphalidae:		
Clossiana dia L.		4
Mellicta athalia ROTT.		2
Comma c-album L.		3
Nymphalis polychloros L.		observed
Aglais urticae L.		5
Vanessa atalanta L.		3
Cynthia cardui L.		2
Apatura ilia SCHIFF.		6
Satyridae:		
Coenonympha pamphilus ssp. *nephele* HUFN.		3

(The author used the works of GOZMÁNY, KOCH, KOVÁCS and VOJNITS indicated in the literature-list to the determination of the material.)

Methods of collection

The author publishes in this paper the data of collections in Mártély in 1971 with 250 W mercury vapour lamp, in Körtvélyes in 1979/80 with 125 W mercury vapour lamp and the data of material collected with special candling (Maxim and propane-butane lamp) and netting. The author was entrusted with the determination of Macrolepidoptera caught by Malaise-trap of Systematical and Ecological Group of Zoological Department of József Attila University, which was used to examine flying insects. The author publishes these data here too with the permission of professor László Móczár.

Results

The author found 224 Macrolepidoptera species in the course of collections carried out with various instruments in Mártély—Körtvélyes environment protection area since 1971, one of them was only observed *(Nymphalis polychloros* L.*)*. The data were established on the basis of determination of 2677 imagos among them 119 individuals of 24 species are diurnal (Table 1). The material of light-trap at Mártély — wich is only partly mounted — was placed in the Zoological Department of Móra Ferenc Museum in Szeged.

The flora and fauna of Mártély and Körtvélyes — despite of their similar natural characters — show significant differences. In order to demonstrate the difference in their butterfly-fauna we can compare the first 20 species on the basis of most frequent individualnumbers from the material of light-trap at Mártély (1971) with the similarly first 20 species from the material of light-trap at Körtvélyes (1979) (Table 2.).

Table 2. *The first 20-20 species of material of light-traps at Mártély (1971) and Körtvélyes (1979) in order of occured most individualnumber*

Mártély	Individualnumber
1. *Scotia segetum* SCHIFF.	62
2. *Athetis furvula* HBN.	46
3. *Xylomiges conspicillaris* L.	45
4. *Axylia putris* L.	41
5. *Emmelia trabealis* SC.	40
6. *Amathes c-nigrum* L.	32
7. *Mythimna pallens* L.	32
8. *Scotia exclamationis* L.	29
9. *Phragmatobia fuliginosa* L.	29
10. *Tarache luctuosa* ESP.	28
11. *Chiasmia clathrata* L.	28
12. *Mamestra aliena* HBN.	27
13. *Mamestra suasa* SCHIFF.	27
14. *Hyphantria cunea* DRURY	26
15. *Tholera cespitis* SCHIFF.	24
16. *Eustrotia candidula* SCHIFF.	20
17. *Spilosoma menthastri* ESP.	18
18. *Apatele rumicis* L.	17
19. *Monima incerta* L.	17
20. *Othosia gothica* L.	17
resp.	
Körtvélyes	
1. *Rivula sericealis* SC.	60
2. *Thephrina arenacearia* SCHIFF.	49
3. *Amathes c-nigrum* L.	48
4. *Hyphantria cunea* DRURY	47
5. *Axylia putris* L.	41
6. *Scotia exclamationis* L.	39
7. *Lomaspilis marginata* L.	39
8. *Emmelia trabealis* SC.	39
9. *Chiasmia clathrata* L.	37
10. *Phragmatobia fuliginosa* L.	33
11. *Pelosia muscerda* HUFN.	27
12. *Tarache luctuosa* ESP.	27
13. *Mythimna pallens* L.	24
14. *Scopula immorata* L.	20
15. *Euchloris smaragdaria* F.	18
16. *Hepialus sylvinus* L.	18
17. *Thalera fimbrialis* SCOP.	18
18. *Plusia chrysitis* L.	17
19. *Mythimna turca* L.	16
20. *Eilicrinia cordiaria* HBN.	16

The 8 years passed between the two examinations can't be reason of this difference. We can find 1 common species from the first 5 species, 5 from the first 10, 8 from the first 20 species. From the 198 nocturnal species of the full list 147 are collected from Mártély 115 are collected from Körtvélyes. The number of common species is only 66, which is 30,3% of the full material.

Tephrina arenacearia SCHRIFF. was on the 91st place in Mártély in 1971 with 3 individuals, while in Körtvélyes in 1979 it was on the second place with 49 individuals. Another outstanding example: *Xylomiges conspicillaris* L. was on the third place in Mártély in 1971 with 45 individuals, while in Körtvélyes in 1979 not a single of them was caught. Such changes can be observed in the case of more species, the reason of them is extremely combined, their origin can be in weather, in the changes of waterlevel of Tisza, in the vapour content of air, in the direction and strenghth of aircurrent during the time of function of traps, in the degree of cloudiness, its lastingness, occasionally in cold- or warm frontal passage, but they are influenced by the composition of culturflora being out of flood plain, moreover by agrochemical works. First of all the differences are explained with the differences in the flora of the two areas altough all of the first 20 species are of wide ecological degree of tolerance not at all bound to plant communities, mostly polyphagous species.

From the enclosed check-list (Table 1) we can see, that a great part of the material is from the Euro-Siberian fauna circle from it the euryoecic autotypical genuses. They don't connect to special plant-communities, their degree of tolerance is almost boundless, and they are generally current in the whole area of the country. (For example the polyphagous *Spilosoma* species, wich is living generally on annual plants: caterpillars of *Spilosoma fuliginosa* L. can be found on nettles — *Urtica urens* — too in Körtvélyes holm.) The other groups of the mentioned fauna-circle are represented by several species. Their occurrence on the examined area and surroundings shows the existence of living spaces satisfying their demand of humidity. The members of arundiphil group as alluvial community, reedy-bulrushy sedgy fauna elements, are less widespread species (e.g. *Archanara cannae* ESP., *Archanara sparganii* ESP., *Scopula corrivalaria* KRETSCHM., *Celaema leucostigma* HBN.). *Helophil* species originated from the Far East are living in greater number on the area (e.g. *Eucarta amethystina* HB., *Eucarta virgo* TR., *Hyssia cavernosa* HBN., etc). *Pelosia muscerda* HUFN. is a species of gallery and marsh, a typical animal of Euro-Siberian birch-willow-alder fenwoods. The marshy euryoecic species characteristic in our Great Hungarian Plain certainly find suitable living space out of the dams too (e.g. *Eustrofia unculata* L., *Scopula immutata* L., *Hydraecia micacea* ESP.), but *Mellicta athalia* ROTT. can be collected only on river flat holms. *Sterrha nitidata* H.-SCH. which is of sybilla area-typical hygrophil wood-component finds its characteristic living space in river flat woods. The sub-Mediterranean *Aplasta ononaria* FUESSL. and *Eilicrinia cordiaria* HB. are mentioned by VARGA (1964) as characteristic species of Praeillyricum, from them only 2-2 individuals were caught. Opposite of the mentioned, the similarly sub-Mediterranean, but psammophil *Porphyrinia noctualis* HBN. occurred on the surroundings of the examined area, but it doesn't in Mártély—Körtvélyes. Individuals of *Sterrha sericeata* HB. from the same group occured often in the traps. *Mythimna conigera* SCHIFF. one of the typical animals of plant-community also often appeared. We have to mention, that it was known as mountain-species with high demand of humidity, altough it was found on the banks of Tisza too. Similarly to the case of *Aplasta ononaria* FUESSL. the possibility of "Bihar-effect" comes up, but it is possible, that it isn't effective in county Csongrád. *Ochnogyna parasita* HB. is ponto-Mediterranean species which is frequent in some places in county Csongrád, East from Tisza similarly like *Glaucopsyche alexis* PODA., one of the most typical elements of steppe, which were collected on the dam at Körtvélyes, and they enrich the check-list of this area. *Gortyna borelii lunata* PIERR. *(Hydraecia leucographa* BKH.*)* is a species without zoogeographical classification; it is an ancient element of steppe; because of its sporadical range its proper place hasn't been cleared up yet. Some pieces were collected in Kelenföld, Naphegy, Vérmező, and Vác, but its most wellknown collecting place is Ohat. During the last 10 years it has appeared in several places in Great Hungarian Plain (from county Békés, Újszentmargita, Mártély, Tápé and from the city of Szeged). *Discestra dianthi* TAUSCH. is Aralo-Caspian salt desert-element, only few individuals were caught altough it occures on several places in the county, but nowhere is frequent. Some leafyforest- resp. oakforest-species occure too (*Dasychira pudibunda* L. resp. *Bena prasinana* L., the first is hornbeam-oak-, the last is Southern-Continental oakforest-species). These appear in all of our oakforests. We have to mention here the leaf-eating noxious *Orthosia gothica* L. and *Panolis flammea* SCHIFF. the last is very frequent in the Southern part of the Plain — it occures in the smallest group of pines already — and they enrich the checklist of Mártély with 17 resp. 5 individuals. Migrant species also were collected, they don't belong to this area, but we have to count with their occurence as faunaelements (e.g. *Nicterosea obstipata* F., the universal *Scotia ipsilon* HUNFN., *Chloridea viriplaca* HUFN. etc.).

The permanent Macrolepidoptera of Mártély and Körtvélyes belong to the animals of higher living spaces. The annually subsequent floods cover many times the level of grass and shrub and this causes the total damage of caterpillars living here. The inhabitants of areas situated lower are flying to the river flat from the areas out of the dams (except the species with more generation in which case during the gradation and during the short development-period wasn't flood). In the case of species with one generation it is very small chance for the development of a population while the situation of species with more generation is much more simple. Nevertheless we can find individuals of both groups on the river flat independently from the fact that the living space of very few species can be found on the grass- and shrublevel.

The re-settlement of Lepidoptera onto the river flat is possible only from the outer side of dams except a low per cent (which consists of individuals coming from holms and hills free of water). This mechanism is very complicated and isn't wellknown neither in the case of Lepidoptera nor of other orders. During the last some years flood was very incalculable and damaged the population or populations of different species. Because of the ability of quick displacement the survival of Lepidoptera species is ensured in every case. Their number sometimes is decreasing but in the average of several years the balance is re-established.

There are some interesting cases, from them I mention *Celaema leucostigma* HBN. Its caterpillar generally lives in the rhizome of *Iris pseudacorus* but sometimes in sprouts of willow. On the river flat of Tisza certainly the individuals developed in sprouts of white willow *(Salicetum albae-fragilis)* are surviving resp. proliferating because *Iris pseudacorus* doesn't perish during the flood but the caterpillars living in its rhizome presumably die in every case.

Habitat of *Iris pseudacorus* generally is in water or on banks of waters (it is standing in water during the whole year in Ócsa, where *Celaena leucostigma* HBN. is more frequent species) so we can consider the animal living in it as a river flat-type. If this animal can live on an other plant too, which hasn't so high demand of water — e.g. the mentioned owlet-moth species can live on willow too — this species can't be considered as typical river flat-species. We can see such cases very often, and we can see, that it is very difficult to determine the idea of the real river flat-species.

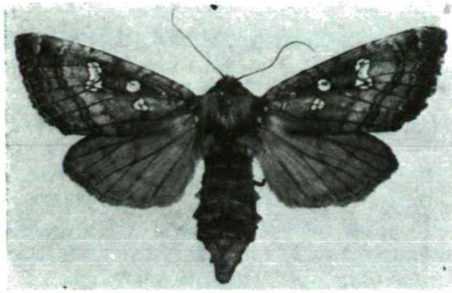


Fig. 1. *Gortyna borelii lunata* PIERR. (Mártély, 1971. okt. 6)

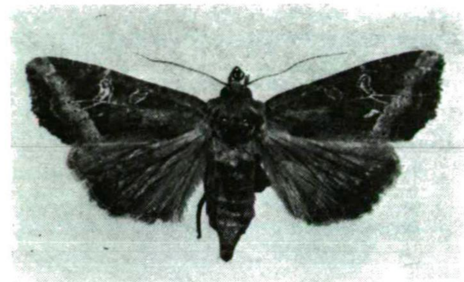


Fig. 2. *Celaena leucostigma* HBN. (Körtvélyes, 1979. júl. 27)

References

ANDÓ, M., BODROGKÖZY, GY. and MARIÁN, M. (1974): Biological and physico-geographical foundations of the social exploitation of the Mártély—Sasér Region conservation District. — Manuscript a Cometition Essay.

GOZMÁNY, L. (1970): Bagolylepkék I. (Noctuidae I). — Magyarország Állatvilága XVI: *11*, 3—151.

KOCH, M. (1972): Wir bestimmen Schmetterlinge III: 39—161. Leipzig.

KOCH, M. (1976): Wir bestimmen Schmetterlinge IV: 42—255. Berlin.

KOVÁCS, L. (1965): Araszolólepkék I. (Geometridae I.) — Magyarország Állatvilága XVI: *8*, 2—55.

VARGA, Z. (1964): Magyarország állatföldrajzi beosztása a nagylepkefauna komponensei alapján. — Folia Ent. Hung. 17—63.

VOJNITS, A. (1980): Araszolólepkék I. (Geometridae I.) — Magyarország Állatvilága XVI: *8*, 4—257.

Adatok a Mártélyi Tájvédelmi Körzet Lepidoptera faunájának ismeretéhez

KOVÁCS S. T.

Tiszakutató Munkacsoport, Szeged, Magyarország

Kivonat

A dolgozat a Tájvédelmi Körzet területén 1971-ben 250 W-os higanygőzlámpával működő, mártélyi és az 1979—80-ban 125 W-os higanygőzlámpával működő körtvélyesi fénycsapdák segítségével gyűjtött anyag feldolgozási eredményét tartalmazza. Ezenkívül a körtvélyesi sziget rétjén felállított és szakaszosan működtetett Malaise-csapda, továbbá a térségben végzett egyedi lámpázással (Maxim, propán-butánlámpa) valamint nappali hálózással gyűjtött macrolepidoptera fajok nevei, mennyiségi adatokkal kiegészítve, rendszertani felsorolásban kerültek közlésre.

Jelzi a Gortyna borelii lunata Pierret (Hydroecia leucographa Bkh.) noctuida faj mártélyi előfordulását. Tartalmazza néhány tipikus és atipikus faj rövid ismertetését ökológiai vagy állatföldrajzi hovatartozása alapján.

Prilog poznavanju faune Lepidoptera zaštićenog okruga Mártély

Kovács S. T.

Radna grupa za istraživanje reke Tise, Szeged, Hungaria

U radu je obradjen materijal sakupljen na području zaštičenog okruga Mártély. Materijal je prikupljen živinim svetlosnim klopkama od 250 W u 1971. godini na području Mártély, i od 150 W u 1979—80. god. na području Körtvélyes. Osim toga u ritu na ostrvu Körtvélyes povremeno korišćene su klopke tipa Malaise, kao i osobna (Maxim) propan-butan lampa. Dnevni ulov Macrolepidoptera pomoću mreže prikazan je spiskom vrsta po njihovoj sistematskoj pripadnosti sa kvantitativnim podacima.

Utvrdjeno je prisustvo noktuidne vrste *Gortina borelii lunata* Pierret *(Hydroecia leucographa* Bkh.) na području Mártély. Dat je kratak ekološki i zoogeografski prikaz za neke tipične i atipične vrste.

ДАННЫЕ К ПОЗНАНИЮ ФАУНЫ ЧАШУЕКРЫЛЫХ ПРИРОДООХРАННОГО РАЙОНА МАРТЕЛЬ

Ш. Т. Ковач

Рабочая группа исследователей Тисы, Сегед, ВНР

Резюме

Работа была нами проведена в 1971 году на территории. Природоохранного района, при помощи 250 W-го мертельного ртутепарфонаря, а также в 1979—80 гг. 125 W-ого ртутетпарного фонаря. Кроме того на лугах острова Кертвельеш ставили приманки Малаисе с другими осветителями (Максим, пропанбутанфонар), а также виловливали мокрочешуекрытых дневным сачным способом. Количественные их состав был дополнен и в систематическом порядке сообщены.

Результаты показали на наличие вида *Cortyna borelii lunata* Pierret, *Hydrocia leucographa* Bkh. noctuida в мартельском районе. Приводятся также ознакомления с отдельными экологическими и зоогеографическими признаками виды

Tiscia (Szeged) Vol. XVII, pp. 174—189 (1982)

COMPARATIVE FAUNISTIC AND OECOLOGICAL INVESTIGATIONS INTO THE AND LAND-MOLLUSKE OF THE KÖRTVÉLYES RESERVATION AREA

K. BÁBA

Department of Biology, Teachers' Training College of Gy. Juhász, Szeged
(Received 15 October, 1981)

Abstract

Author carried out sampling at 21 places between 1959—1981. The low number of (7 living species) caused by two factors. As it is a low inundation area, floods cover it 2—3 times a year. (This is well shown by the low numbers of diversity and eveness — Table 3) Agriculture an forestry decrease this number too.

The species composition of snails in indigenous foreststands corresponds to the situation in the other areas in Tisza valley (BÁBA 1980b).

The light intensity, the the cover of forest-stands influence the number of species and individuals (Table 2, 3, Fig). Light-shadow conditions influence the snails' distribution.

Mollusk-fauna of aquatic biotops is similar to that of other dead reaches andnavvy hol es. In different areas of the Low, Middle and Upper regions the defected differences of mollusk-faunae of dead branches and navvy holes (Table 1) are caused partly the unexploredness and partly by the differences, of the samplings of water vegetation's successive condition.

Survey of Körtvélyes dead reach was based on a mosaik-like reconstruction and their comparison of snail populations of different successive conditions. (Table 4) The mollusk-fauna of water biotops is similar to that of other dead reaches and navvy holes. The later ones were dryed out at Körtvélyes by forest settlement. The dead reach is to be found on a stage of natural aggradiation. Cultur-effect can be observed in the bottom's fauna (shell-decay). Vegetation disturbance is marked by the increase of individual number of few species and other ones disappeare. (Table 4; 4 Fig)

Area reconstruction is to be solved by providing the necessary oecological circumstances for the forests' soilfauna (shadow-effect, double foliage-level) and by the elimination of water-polluting and cultur effects.

Introduction

The Körtvélyes dead branch area of river Tisza is a well-known territory of the Southern part of the Great Hungarian Plain. It has been the favourite place of excurtion and spa of the Szeged and Hódmezővásárhely inhabitants since the beginning of our century. Having become a reservations area it remained a frequented fishing place and (today already prohitbited) spa.

Forestry and fishing are characterisic for the territory, which has it been discovered from scientific point of vieu of its popularity.

Reconstruction plan of the reservation area hasrequired its discovery.

Materials and Methods

Faunustis and phytocenological collections were carried out in 20 biotops here in 1959 and between 1976—81. Quadriting metod (25×25 cm) was used for collection, there were 10 quadrats in each biotop respectively. The same method was used when collecting from the bottom of shallow (50—70 cm) water of the dead branch (unter the examined water-plants).

Data collected were compared with those of other Tisza dead branches, navvy holes and flood-plains to explain wether the Körtvélyes-relations are characteristic for the other parts of the Tisza valley.

(BÁBA 1958, BÁBA—ANDÓ 1964, BÁBA 1965a, b, 1967a, b, 1970, 1970—71, 1972, 1973a, b, 1975, 1975a, b, 1978, 1979a, b, c).

Data of CZÓGLER 1927, 1935, ROTARIDES 1931, HORVÁTH 1958, 1962, 1972, and the data of species-spreading based on HORVÁTH's and BÁBA's collections and other authors finding lists (PINTÉR—RICHNOVSZKY—SZIGETHY 1979, RICHNOVSZKY—PINTÉR 1979) were used as well.

Diversity, evenness and zoogeographical distribution were taken into consideration when analyzing the collected landmaterial (BÁBA 1980a, b).

Collected snails of both livinig-spaces were examined from the wiew of their to the vegetation succes.

Examined collecting areas were as follows:

1. Pre-Tisza.
2. *Salicetum triandrae* 100 quadrats of the collectiag area on 30. VIII. 1978 to explain distributive relations.

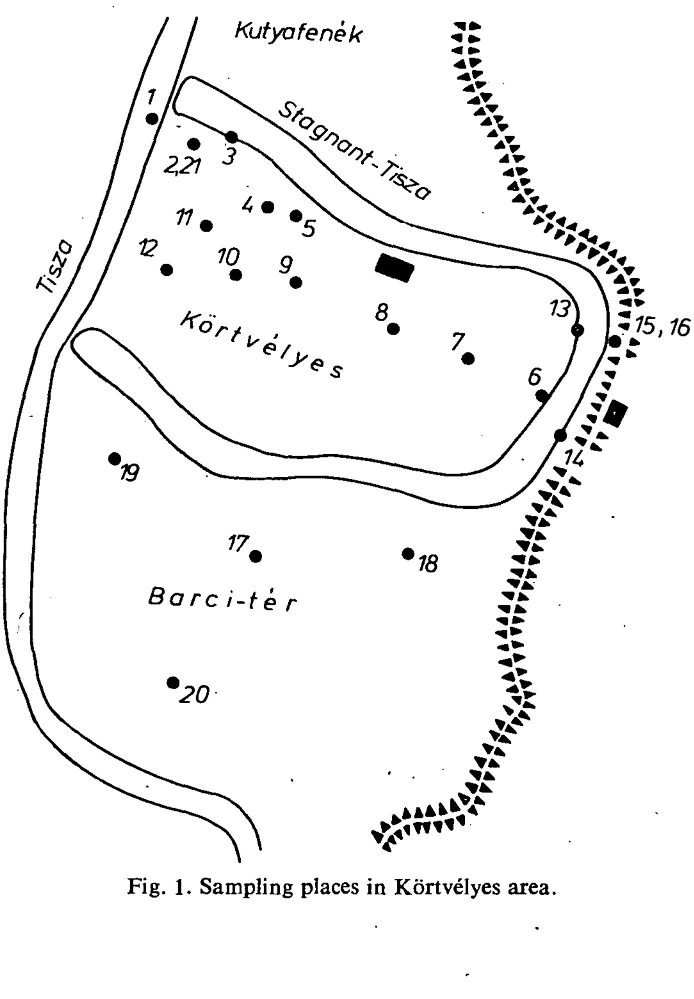


Fig. 1. Sampling places in Körtvélyes area.

3. *Salicetum albae-fragilis*. 1, 2, 3 on the dead branch's side near to „Kutyafenék" and Tisza. *Rubus, Aristolochia, Polygonum hydropiper* undergrowth.

4. Planted poplars, (with *Amorpha* shubbery in front of the research house. 5. *Amorpha* shrubbery. 6. Willowgrowes and the dead branch's bank. — Rubus *Xanthium strumarium* undergrowth. 7. Improved poplar- American ash-forest without undergrowth 70 km from the dead branch. 8. Selected oak-American ash-forest 150 km from the dead branch, level of shrubbery: *Amorpha*. 9. Ploughed meadow among young planted willows, *Xanthium*, meadow-willowy. 10. Drying-out pool, plash among old willowgrowes: *Rubus Carex*-cover. 11. Home-poplar group without undergrowth *Rubus*. 13. Dead branch with vegetation *Trapa natans*. 14. Dead branch without aquatic vegetation. 15. Navvy holes along thedike with wilowy-plants alongs ridges. 16. In 1959 a canal connecting navvy holes has built on the place of 15. collecting area. At some places Rubus. 17—20. „Barci-rét" (meadow area). Quadrating collection (50-50 quadrat each) was carried out in the 2. and 3. collecting areas, at 5 places in each, in the other places 10 quadrats were placed. 1, 10, 14, 15, 16 collecting areas are aquatic biotops. Localities of collecting areas are shown in 1. Figure.

Intensity of light was measured and registered in willow and poplar growes.

For providing chemical data I am greatful to Dr. Klára Füredi, to the head of the laboratory of waterchemistry of Water-economis management of Szeged. I owe a debt of gratitude to Gy. Bodrogközy for the control of plant-oecological data.

Characterization of the collecting area

(A) Land collecting areas: Two important factors are characteristic for the Körtvélyes area and "Barci" meadow:

1. They belong to the lowest inundation areas, during spring, summer and autumn floods the water expands up to the dikes. In recent years except for the spring and autumn floods, the summer one had been covering the territory for a relatively lomg time. The above-mentioned conditions influenced the stocking of the fauna and its multiplication from two viewpoints: the snails' multiplication is inhibited by the long lasting spring-flood, while snails had been carried occasionally by the spring-flood are killed by the summer one.

2. Cultivation-effects are characteristic for the whole area, included by the dead ranch of Tisza at Körtvélyes. Natural vegetation is to be found on along the Tisza embankment and the dead ranch near Kutyafenék. In other parts of the area signs of successful and unsuccessful afforestation, are to be found. Improved poplars-with American ashes are dominant. *Amorpha fruticosa* runs wild after harvest. The majority of bare territories has been cultivated partly for agricultural production (maize) and partly for wilow plantations. Ypung willows were settled in lines. Naturism of a reservation area is not proper for its reconstruction.

(B) Aquatic collecting areas: can be divided i to three groups.

1. Temporarily water-covered places: plashes (collecting area No. 10.) navvy

(B) Aquatic collecting areas: can be divided into three groups. 1. temporarily water- covered places: plashes (collecting area No. 10.) navvy holes (coll. area No. 15). 2. "runhing" Tisza river (coll. area No. 1.). 3. dead branch.

1a. Temporarily water- covered places: plashes remain for a short time after flooding out quickly. The examined shallow navvy hole having planted with willows dried out quickly.

2. The running Tisza's fauna-condition depends on the river's current condition. (Bába 1977, Tóth—Bába 1981.)

3. Dead branch is influenced by the following factors:
   (a) The sewage of till unknown quality and quantity carryed by the outer Hódmezővásárhely belt-canal, the so called Cigányér.
   (b) The illegal swimming and fishing.

(c) The rotting water nut *(Trapa natans)* as had made the fishing difficult was taken of the water at some places.

Water-quality: can be followed since 1976 using the data recorded by the laboratory of water chemistry of Water economic management. The waters type in spring a Ca—Mg—HCO_3 which in summer changes for CaNa sometime parallelle containing is Ca Mg HCO_3 which in summer changes for CaNa sometime paralelle containing carbonate. Sometimes in Summer CO_3 is combined with SO_4 and Cl. With this pH becomes more alcaline varying between 7—8 pH. Comparing the total salt-content of this area to the other Tisza dead branches is low (300—$500^{\pm 50}$ mg/l.

1. Class water quality was measured from the viewpoint of organic material-quantity according to the Comecon specification with permanganate and chromat methods. The similar result was recorded in the case of dissolved oxygen (6.0 ml/l) that was as high as 18.1 ml/l in June 1976, and fell below 6.0 ml/l in September 1980. Biological oxigen demand (BOD) shows extreme changes: in June 1970 it was extremely high, that of 3rd class meaning polluted water. Sometime fishdeath was defected in the dead branch.

The mud of dead arm sporodically smells bad, especially where water nut. Is to be found quantity of NH_4 is below 1.5 mg/l, that shows a slowly increasing tendency in comparison with the 0.5—0.6 mg/l in 1976. This increace shows the moderate rise of human pollution. Quantities of NO_3, PO_4 and solved P are small. Chemical investigations of mud and pesticide weren't carried out. The ewater of the "Cigányér" examined either.

History of malacological researches in Körtvélyes area

This area hasn't drew the malacologists' attention for a long time. Since the 1920—30 ies only 9 species have been observed (Table 1. Column 2) By Czógler (1927, 1935) and Rotarides (1931). All those species were aquatic, there were no landspecies collected.

Much better was studied the fauna, of the spongy area of Nagyfa, Atka, and Hódmezővásárhely's surroundings, which were examined besides the above-mentioned authors by Horváth 1972, Bába 1964-as a result of which 14 aquatic species were found (Table 1. Column 1) Land-fauna was found here also sporodically, (Table 1. Column 1, 2), alltogether 9 species. The flood-area of Atka is situated higher that of Körtvélyes, consequently *Helicella obvia, Monacha, Truncatellina* can only be found in this area. *Unio crassus, Pseudanodonta* of aquatic species were found only in the Tisza during the previous collections, though the author of this paper couldn't find them, in marginal water. *Bithynia leachi* prefers oxygen rich water (Richnovszky—Pintér 1979), its lack in Körtvélyes is the possible consequence of other biological oxygen demand of water. Instead of *Acroloxus* species, *Ferrissia* was found in Körtvélyes. It is doubtful wether this lately identified species living in eutropic waters (alluvial) has outplaced *Acroloxus* from Körtvélyes. Tis datum of appearance in Mártély and Körtvélyes must have been based on earlier authors' misidentification. *Radix peregra* hass been found only in Körtvélyes until now (Horváth 1972).

Datum of Czogler (1935) is an important information about the dead branch's aquatic flora. He found *Potamogeton crispus, Ceratophillum demersum* vegetation.

Discovered species and their description

(A) Land species: Number of discovered species is 7, that is 138 individuals. Inhibiting factors of species' stocking are: lowness floodarea, irregular floods. unsatisfactory closing of haves in forest-stands. According to light-measurements and Ant's

Table 1. *Aquatic and land species of Körtvélyes area compared with those of the Tisza dead reaches and navvy holes*

	1	2	3	4	5	6	7	8	9	10	11	12
Viviparus contectus (MILLET 1813)			+			+	+	+	+	+	+	+
Viviparus acerosus (BOURG. 1862)	+	+	+	+	+			+	+	+	+	+
Valvata cristata (O. F. M. 1774)								+				
Valvata piscinalis (O. F. M. 1774)								+		+	+	+
Valvata pulchella (STUDER 1820)								+				
Lithoglyphus naticoides (C. PFEIFF. 1828)		+	+					+			+	+
Bithynia tentaculata (L. 1758)	+		+	+		+		+		+	+	+
Bithynia leachi (SHEPP. 1823)		+						+				+
Acroloxus lacustris (L. 1758)	+	+					+	+	+		+	+
Lymnaea stagnalis (L. 1758)	+		+	+			+	+	+	+	+	+
Stagnicola palustris (O. F. M. 1774)	+		+			+		+	+	+	+	+
Stagnicola corvus (GM. 1788)								+				
Galba truncatula (O. F. M. 1774)							+	+	+	+	+	+
Radix auricularia (L. 1758)	+						+	+	+			
Radix peregra (O. F. M. 1774)	+						+	+	+			
Radix peregra f. *ovata* (O. F. M. 1774)			+	+		+	+	+	+	+	+	+
Aplexa hypnorum (L. 1758)								+				
Physa fontinalis (L. 1758)	+		+	+		+	+	+	+		+	
Physa acuta DRAP. 1805	+							+	+			+
Ferrissia wautieri (MIROLLI 1960)			+			+		+				
Planorbarius corneus (L. 1758)	+		+	+	+	+	+	+	+	+	+	+
Planorbis planorbis (L. 1758)							+	+	+	+	+	+
Anisus septemgyratus (RM. 1835)								+				
Anisus spirorbis (L. 1758)							+	+	+	+	+	+
Anisus vortex (L. 1758)								+			+	
Anisus vorticulus (TROSCH. 1834)								+				+
Gyraulus albus (O. F. M. 1774)	+	+	+			+	+	+	+	+	+	
Gyraulus laevis (ALDER 1838)								+				+
Armiger crista (L. 1758)	+						+	+	+			
Hippeutis complanatus (L. 1758)	+						+	+	+			
Segmentina nitida (O. F. M. 1774)								+	+	+	+	
Unio crassus (RETZIUS 1788)		+										
Unio pictorum (L. 1758)	+	+	+						+			
Unio tumidus (RETZ. 1788)	+		+				+	+	+			
Anodonta anatina (L. 1758)	+	+						+	+			+
Anodonta cygnea (L. 1758)	+	+	+		+	+	+	+	+			
Pseudanodonta complanata. (RM. 1835)	+	—	—		—	—	—	—	+			
Dreissena polymorpha (PALLAS 1771)	+	—	+		+			+	+			
Sphaerium corneum (L. 1758)							+	+			+	
Musculium lacustre (O. F. M. 1774)			+	+			+	+		+	+	
Pisidium henslowanum (SHEPP. 1823)								+				
Pisidium sp.			+	+								
together:	19	9	17	8	4	9	18	38	24	14	19	18
land species together: together:								40			24	

	1	2	3	4	5	6	7
Cochlicopa lubrica (O. F. M. 1774)	+						
Truncatellina cylindrica (FÉR. 1807)		+					
Vallonia pulchella (O. F. M. 1774)			+			+	
Chondrula tridens (O. F. M. 1774)	+	+					
Succinea oblonga (DRAP. 1801)							
Succinea elegans (RISSO 1826)	+		+	+	+		
Zonitoides nitidus (O. F. M. 1774)			+	+	+	+	0
Deroceras agreste (L. 1758)			+	+	+	+	+
Euconulus fulvus (O. F. M. 1774)			+			+	
Helicella obvia (HARTM. 1840)	+	+					
Monacha cartusiana (O. F. M. 1774)		+					
Perforatella rubiginosa (A. SCHM. 1853)			+	+	+	+	0
Cepaea vindobonensis (FÉR. 1821)	+						
Helix pomatia (L. 1758)							
together:	9		7	5	5	6	1

Key to the signs of land species:
1. DS 43, 44, 54 Hódmezővásárhely, Atka (according to PINTÉR—RICHNOVSZKY—SZIGETY in 1979)
2. Species found in the inundation area of Atka (BÁBA 1957)
3. Species found in Körtvélyes (BÁBA 1976—1981)
4. *Salicetum triandrae* — Low-Tisza region (BÁBA)
5. *Salicetum triandrae* (Körtvélyes)
6. *Salicetum albae fragilis* (Körtvélyes)
7. Settled forests (Körtvélyes)
   0 = dead samples

Key to the signs of aquatic species:
1. Species found in Atka, Mártély, Nagyfa, Sasér, Hódmezővásárhely by CZÓGLER, ROTARIDES, HORVÁTH and BÁBA
2. Species found by CZÓGLER and ROTARIDES (1927—1935)
3. Species found in Körtvélyes (BÁBA 1976—1981)
4. Species of wilow-populated navvy-holes and plashes (BÁBA)
5. Bottom of dead-reach without aquatic vegetation
6. *Trapetum natantis* in plant population
7. Fauna of the dead reach along the Upper-,
8. Middle-, and
9. Lower Tisza regions
10. Fauna of navvy holes along the Upper-,
11. Middle-, and
12. Lower Tisza region

Table 2. *Comparison of light-intensity of some plant-communities in shaded, half shaded and sunny areas*

Locality, vegetation	Lihgt-values Average shade	half-shade	sunlight	Number of species	indivials
willowy (Körtvélyes) 1978. 8. 30.	150	300	4 000	3	8
willow+poplar growes (Körtvélyes) 1976. 8. 6.	396	850	2 144	6	47
thinned out stand	1172	2040	4 525	—	—
poplar gallery-forest (Gemenc) 1976. 7. 21.	1277	9666	19 550	—	—
elm—oak—ash gallery-forest					
Bagiszeg 1975. 5. 22. (asperuletosum)	100	254	1 550	10	108
Bátorliget 1975. 8. 24. (asperuletosum)	62	312	1 400	14	168

publication in 1963 the discovered species are moderately light demanding: between 30—450 lux. The light are relations of the investigated area compared with those of other forest-stands in Table 2.

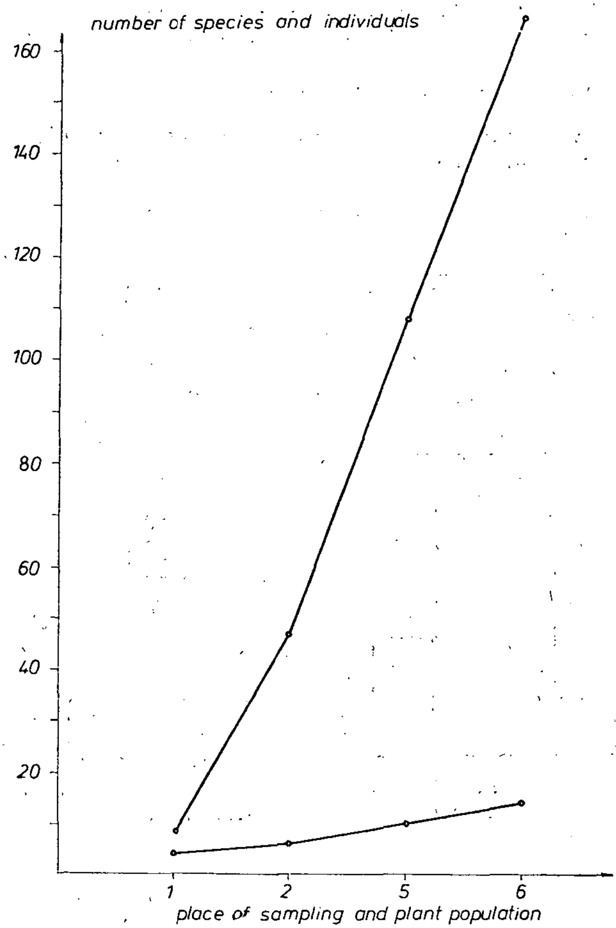


Fig. 2. Species and individual relation of the snail populations of the mineralogen plant-succesion in inundation and agricultural areas (according to the numbering of Table 2).

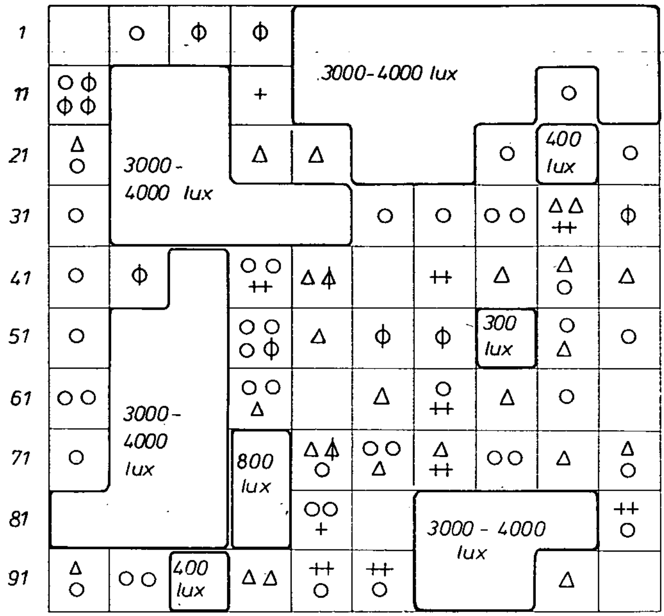
According to the Table is not cultivated or thinned out forest stands there are more shaded parts', as a consequence of this and that of hydrological conditions the number of snail species and individuals grows. 2. Figure well illustrates the species-individual relationship.

As a consequence of above-mentioned effects from the measured 260 quadrats there were only 15 containing snails, (quadrats in 5, 76).

Living individuals were found only in willowy and willow-poplar stands. In the 6th collecting area a living *Deroceras agreste* was found. One seedy shell of *Zonitoides* (7. collectingarea) and 2 of *Perforatella* were found in flood deposit. Living individuals were found in soil-rents and on the back of dried willow leaves.

3. Figure illustrates the effect of illumination on the snails; distribution in *Salicetum triandrae* stand. The frequency of the young individuals of the discovered 4 species correspond to the conditions of the year 1976 (Table 3). There were no living snails in sunny places at 3—4000 lux light. As a rule they were to be found-

between 30—150 lux. The changing numbers of individuals in quadrats must be connected with the surface-soil's humidity conditions. Estimation with *Zonitoides nitidus* $\frac{S^2}{\bar{x}}$ shows uneven. distribution The number of *Zonitoides nitidus* is the gratest in this area. Exept for *Succinea elegans* (holomediterran) all the, species belong to the Siberian-Asiatic fauna (BÁBA 1980a).



	number of individuals	D %	F %	Juv %
O *Zonitoides nitidus*	51,9	58,62	36-40	17,64
Φ juv.				
Δ *Perforatella rubiginosa*	26,2	29,88	22-20	7,65
juv.				
+ *Deroceras agreste*	2	2,29	2-10	-
++ *Succinea oblonga*	8	9,19	8-10	-
	87,11	99,98		12,64

Fig. 3. Distribution in the forest-stand of Salicetum triandae in Körtvélyes area 30. 8. 1978.

(B) Aquatic species: 229 individuals of 16 species were found on 60 quadrates. Number of living species is 101 (in 14th coll. area *Dreissena* was found). In aquatic-biotops more living species were found in comparison with land areas. Tables compare species found in Tisza's dead branches (Table 1, Columns 7—9) along the Upper- (Tiszabecs), Middle- (Szolnok) and Lower reaches of Tisza (up to the forntier) on the base of BÁBA's and HORVÁTH's collections, completing the previous data of Körtvélyes. *Bythnia tentaculata, Ferrissia* wautieri haven't been found in Tisza's Lower reach collections. At the same place there were no *Physa fontinalis Musculium lacustrae* and *Pisidium sp.* in navvy holes (Table 1, Columns 10—12).

Diversion in species-distribution in the dead branches of different reaches and navvy holes are partly caused by the limited number, of examinations, and by the fact that collections were carried out in diverse vegetation-associations (BÁBA 1967, ÖKLAND 1979). Dead branches of the Upper and Lower Tisza reaches are less discovered. There is a much less diversion in the navvy holes' fauna alomg the three courses. Differences in the species-number of dead branches and navvy holes are due to their differences in water quantity. The navvy holes' vegetation-poverty and changing water-level (frequent drying out) also explain these differences. Determinant factors of the navvy holes' fauna are its the bottom's character the hole's extension, age and water-depth (BÁBA 1964).

Of the 68 water-snail species, indigenous for Hungarian fauna (PINTÉR 1974), 13 species must be excluded as they live in river brooks and caves and *Anisus leucostoma* the appearance of which is uncertain and shallow-water *Bathyomphalus*. Excluding 4 of the 23 shell species, that are positively found in running waters, the estimated number of mollusks in dead branches and navvy holes is 51. According to the Columns 3, 7.12 of Table 1. 41 species of them have already been found. New elements are to be exoected from *Pisidium* soecies first of all, though they live mainly in sandy shallow and marsh-waters.

The fact, that species found in 13, 14 collecting areas and in all aquatic biotops, exept for that of the Upper course of Tisza, are detritus cinsumers and live in beta-meso saprob waters (FRÖMMING 1956, HÄSSLEIN 1966, RICHNOVSZKY—PINTÉR 1974, GULYÁS 1976) strikingly illustrates the effect of the water's qualitaty and quantitaty. The algae and other green plants and bacteria concumung *Lymnaea stagnalis* and *Physa fontialis* are unuque: *Dreissena* is also exeption prefering oligo-beta mesosaprob conditions.

Phytocenological and zoogeographical results

(A) Land snails: Snail-groups found in plant-associations *Salicetum triandrae* (2. collecting area) and *Salicetum albae-fragilis* (3. coll. area) well illustrated the differences characteristic for the snails-groups of two plant-associations reflected by the species and individual number (Table 3).

Frequent dominant species is in both cases *Zonitoides nitidus*. Similarly to other low inundation areas of the Tisza-valley, the Shannon- Wiener function and eveness are low in Körtvélyes as well. The effect of higher level is detectable in case of wilow and ppplar-growes only in species-number, but in the increase of individual number, in species densyty and the increase of young individuals (BÁBA 1980b).

According to the data of earlier investigations (BÁBA 1980b) differences in the succesive phases beetween the two forest-associations can be well demonstrated: biotops have become dryer in consequence of the higher level (W=8.5—7.2) so the individual number, the A/m² value and the species density increase.

From the viewpoint of plant. geography both forest-types are warm-continental (MAYER 1968). The forest-snail populations- have also continental character. The distribution of snails in willowy: 33.3% holomediterranean, 66.7% Siberic-Asiatic; in willow-poplargrowes 100% Siberic-Asiatic, that is snails with continental climatic requirements.

Table 3. *Number of individuals*

	Salicetum triandrae			*Salicetum albae. fragilis*		
	individual	D%	F%	individual	D%	F%
Vallonia pulchella	—	—	—	1	2.12	10
Succinea elegans	1	12.5	10	—	—	—
Succinea oblonga	2	25.0	20	2	4.25	25
Zonitoides nitidus	5	62.5	40	40	85.10	90
Deroceras agreste	—	—	—	1	2.12	10
Euconulus fulvus	—	—	—	2	4.25	20
Perforatella rubiginosa	—	—	—	1	2.12	10
Σ individual	8	100		47	99.96	
A/m²	12.8					75.2
Juv. %	12					68
species frequency	0.7					1.6
Shanon-W.	1.360					0.9401
JA	0.8586					0.3637
T, W, localities' average	5 8.5					5 7.2

(B) Aquatic mollusks: different types of Waters are frequented by different dominant species. The only species in shell is *Musculim lacustrae* that well bears the plash's drying out, 4 dead samples of it were found.

Navvy holes of Körtvélyes are poorer in species compared to those of Atka (Bába—Andó 1964). Species-composition of 1959 and 1981 surveys is different which is caused by the hole's drying and the wilow-stockings. *Viviparus acerosus* was both cases frequently dominant (Table 4, (1959) Columns 1. 2, (1981)).

Mollusks of the plantless shallow dead branches edge are similar to those of the fauna-composition "Hosszú Böge" (1972) of Tisza 11. reservoir area (Table 4, Colums 3, 4) (3 Hosszú-göbe).

In both areas *Anodonta cygnea* is frequently-dominant.

Mollusk-composition of the dead reach's plant-associations can be discussed by comparing the successive conditions before and adter the water-nut period. Vegetation described by Czóger in 1935- must have been the weedy preceiding the water-nut one (Column 5: *Myriophyllo-Potametum myriopylletosum spicati* Soó 1957, 18. VII. 1969. Kerek Böge, Bagi Reservoir. Weedy condition is followed by the monocultura of *Nymphaeto albo-luteae*. The so called water-nut-condition, Which represents a stage of natural eutrofisation. (Column 6: Abádszalók, dead brach of Tisza, 19. VII. 1972. Column: 7: Körtvélyes, 22. IX. 1981. water-nut, Column 8: Borzanati, dead branch of Tisza and Nagy-Varjas (Bagi Reservoir 18. VII. 1969) *Scirpo-Phragmitetum schoenoplectosum* Soó 1928 and *Nymphoidetum peltatae* (Allorge 1922) are the combination of the reed-period following the water-lily and water-nut ones. Mollusk-associations of different periods' plant successions can be casily distinquished with the help of Table in respect for their species stock, individual number and frequently dominant species in the different dead reaches. It must be stressed, that the weed's subfrequent dominant species becomes dominant in the

Table 4. *Comparison of aquatic-mollusk populations*

	1			2			3			4			5			6			7			8		
	Σ	D%	F%	Σ	D%	F%	Σ	D%	F%	Σ	D%	F%	Σ	D%	F%	Σ	D%	F%	Σ	D%	F%	Σ	D%	F%
Viviparus contectus																1	3.03	10	4	6.06	20	3	3.15	30
Viviparus acerosus	9	26.47	60	7	63.63	60	1	2.27	10	8	7.01	70				—	—	—	—	—	—			
Valvata puchella													8	9.20	30									
Bithynia tentaculata	4	11.76	30	—	—	—							49	56.35	100	5	15.15	30	14	21.21	50	7	7.35	40
Acroloxus lacustris													4	4.60	20							43	45.15	80
Lymnaea stagnalis	4	11.76	40	1	9.09	10							3	3.45	30							4	4.20	40
Stagnicola palustris																1	3.03	10	3	4.54	20			
Galba truncatula																						1	1.05	10
Radix peregra																1	3.03	10	—	—	—			
Radix peregra f. ovata	10	29.41	60										12	13.80	70	13	39.39	50	15	22.72	90			
Physa fontinalis				1	9.09	10													10	15.15	40	10	10.50	50
Ferrissia wautieri																1	303	10	17	25.75	80			
Planobarius corneus	3	8.82	30	2	18.18	20							8	9.20	60	1	3.63	10	1	1.51	10	21	22.05	80
Anisus vortex																						12	12.60	50
Anisus vorticulus																						1	1.05	10
Gyraulus albus													2	2.30	20	4	12.12	30	1	1.57	10	2	2.10	10
Unio pictorum							8	18.18	20	—	—	—				1	3.03	10						
Anodonta anatina																2	6.06	20						
Anodonta cygnea							35	79.54	100	105	92.10	100				3	9.09	30	1	1.51	10			
Dreissena polymorpha							—	—	—	1	0.87	10												
Sphaerium corneum																						1	1.05	10
Musculium lacustre	3	8.82	30	—	—	—							1	1.15	10									
Pisidium sp.	1	2.94	10	—	—	—																		
Together:	34	99.98	—	11	99.99	—	44	99.98	—	114	99.98	—	87	100	—	33	09.99	—	66	99.96	—	95	100	—

waternut period *(Radix peregra f. ovata)*. Waternut period wins 8 snail and shell species respectively and looses 3 snail and shell species during the change of successive phase. The metod of comparing the results of different localities of a successive period is supoorted not only by the species-identity (8 out of 12 species) of mollusks at two different water-nut areas, but the their common frequently dominant species: the *Radix peregra* f. *ovata*. In the case of the common species levels of frequency and dominancy are similar with a deviation of 10—20%. It must be noted, that *Stagnicola palustris* in both water-nut areas belongs to the form turricola (Held) Pieczhocki stated that it is independent species (1979) in the review of PINTÉR—RICHNOVSZKY—SZIGETHY it is marked as *Stagnicola* aggl. (Between the individual numbers of the two water-nut areas there is a difference of 50%. The species-number of Körtvélyes-ares is lower, showing the ares's being disturbed, the water nut's lifting out).

Disturbing effect is followed by increase of individual number and the species-number is small. (FELFÖLDY 1974, p. 52) This is illustrated by the species-individual relation (Fig. 4).

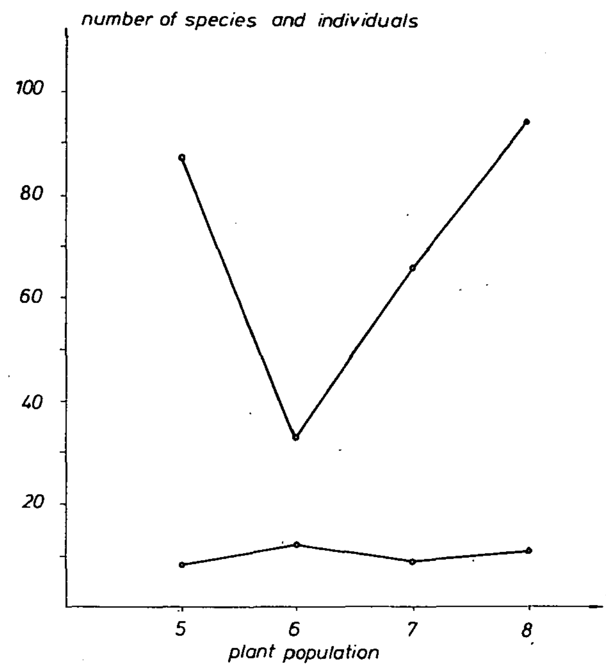


Fig. 4. Relation of species and individual numbers in weedy, water-nut, reed and water-lily successive conditions in the surveyed dead reaches (according to the numerating of Table 4).

The autor of the present paper hasn't got any data on the successive condition immediately following the water-nut period. A further condition is illustrated by the water lilly complex of the Column 8. This complex differs from the water-nut period both in species-composition and frequently dominant species *(Acroloxus lacutris, Planorbarius corneus)*. Snail-composition of similar plant complexes (BÁBA 1967a) also differs from that of the water-nut period.

Discussion

Comparing the results of the Körtvélyes land and samplings those of other areas, the next conclusions can be drown on the area's condition.

The land biotops are poor both in species and individuals caused by the area's low level. Individual number was also decreased by the strong cultur influences (agricultures, stocking are relatively richer in light than indigenous forest, because of the method of new forest (willoies settlement).

Navvy holes have been changed by their ploughing and by forest-settlements along ridges. Polluted waters of Cigányér (meaning the irregular fluctuation of BOL_5) water-nut's lifting out, resulted in swimming which is prohibited and in natural aggradiation, eutropization of the dead reach (this is marked by the apperance of *Trapa*). Culture-effects results in the relatively higher individual number of the few species and the great shell decay.

The next suggestions can be made to the planned area-rekonstruktion:

1. New-forest settlements of indigenous species (willow, Willow-poplar, sporodically in higher areas oak) — with second foliage level. The modern largescale forest-settlement methods must be adapted especially in the case of navvy holes along the dams. It results in the changing the character of aquatic and land biotop. The water at the bottom of the dam's slope disppears, the upper-soil of the forest-biotpo becomes dryer.
2. The water of Cigányér conducted into the dead reach, must be being cleaned if we want to protect' this area. The aquatic plant's lifting out must be stopped (controls, fees). The fishing cooperative of the area must be made consider strictly the area-reservation rules.

References

ANT, H. (1963): Faunistische, ökologische und tieregrographische Untersuchungen zur Verbreitung der Landschnecken in Nordwestdeutschland. — Abb. aus Landesmus. für Naturk. Zur Münster in Westfalien *1*, 1—125 Münster.

BÁBA, K. (1958): Die Mollusken des Innundationaraumes der Maros. — Acta Biol. Szeged *4*, 67—71.s

BÁBA, K., ANDÓ M. (1964): Mikroklíma vizsgálatokkal egybekötött malakocönológiai vizsgálatok ártéri kukokban (Malakophytocoenological and microclimatic investigations in inundations area's holes). — Szegedi Tanárk. Főisk. Tud. Közl. *2*, 97—110.

BÁBA, K. (1965a): Einige Daten zur Cönose der Muscheln. — Tiscia (Szeged) 63—64.

BÁBA, K. (1965 b): Malakocönologiai vizsgálatok a Tisza árterén. (Malakophytocoenological investigation in the inundation area of river Tisza). — Szegedi Tanárk. Főisk. Tud. Közl. *2*, 93—98.

BÁBA, K. (1967a): Malakozönologische Zonenuntersuchungen im toten Tiszaarm bei Szikra. — Tiscia (Szeged) *3*, 41—55.

BÁBA, K. (1967b): Adatok a vízicsigák megoszlását megszabó tényezőkhöz (Some contributions to the factors deciding the water-snails' distribution). — Szegedi Tanárk. Főisk. Tud. Közl. *2*, 3—12.

BÁBA, K. (1970): Ökologische Beobachtungen bezüglich der Schneckenarten im Tisza-Tal. Die Besiedlung des Innundationsraumes. — Móra F. Múzeum Évk. Szeged *1*, 93—100.

BÁBA, K. (1970—71): Malacocoenoses of backwaters of the Upper Tisza with varions vegetations. — Tiscia (Szeged) *6*, 89—94.

BÁBA, K. (1972): The snail coenoses of the willow growes in the Middle Tisza region. — Tiscia (Szeged) *8*, 101—103.

BÁBA, K. (1973a): Wassermollusken Zönosen in den Moorwäldern Alnion glutinosae (Malcuit) der ungarischen Tiefebene. — Malacologia *14*, 349—354.
BÁBA, K. (1973b): Peopling of the inundation area of the Tisza by Mollusca. Regeneration of the snail populations in the area of river barrage Tisza II. — Tiscia (Szeged) *7*, 98—99.
BÁBA, K. (1975): From where the woods of the Tisza Walleys arc populated by snails from the Greet Hungarian Plain. — Tiscia (Szeged) *10*, 109—110.
BÁBA, K. (1977a): Mollusca In: HAMAR J., B. TÓTH M., VÉGVÁRI P.: Adatok a Tisza környezettani ismeretéhez, különös tekintettel a kiskörei vízlépcső térségére (Some contributions to the oecological studies about the river Tisza, with special regard to the area of river barrage „Kisköre"). — Kisköre 60—64, 195—196.
BÁBA, K. (1977b): Die kontinentalen Schneckenbestände der Eichen-Ulmen-Eschen-Auwäldern (Fraxino pannonicae-Ulmetum pannonicum Soó) in der Ungarischen Tiefenebe. — Malacologia *16*, 51—57.
BÁBA, K. (1978): The water carried Mollusks of our rivers and the analysis of the fauna of the deposit. — Tiscia (Szeged) *13*, 186.
BÁBA, K. (1979a): Magyarországon védendő puhatestű fajok (Mollusk species of Hungary to be defended). — Juhász Gy. Tanárk. Főisk. Tud. Közl. *2*, 25—30.
BÁBA, K. (1979b): Stocking of the flood-plain with Mollusc species and some lessons of succession. — Tiscia (Szeged) XIV, 243—244.
BÁBA, K. (1979c): Die Succession der Schneckenzönosen in den Wäldern des Alföld und die Methoden zum Studium der Succession. — Malacologia *18*, 203—210.
BÁBA, K. (1980a): Eine neue zoogeographische Gruppierung der ungarischen Landmollusken und die Wertung des Faunabildes. Haliotis 10/2/15.
BÁBA, K. (1980b): Investigation into the succession of snails associations in the flood plain of the river. — Atti IV. Congresso S. M. I. Siena 6—9 oktobre 1978. Atti Academia Fisiocritici Siena, 177—192.
CZÓGLER, K. (1927): Szeged környékének kagylóiról (About the snails of Szeged area). — Schwarz J. Nyomhája Szeged, 1—29.
CZÓGLER, K. (1935): Adatok a Szeged-vidéki vizek puhatestű faunájához (Some contributions to the water mollusk fauna of Szeged area). — Szegedi Állami Baross G. Reáliskola-Reálgimn. LXXXIV. Tanévi Értesítője. Széchenyi Nyomda Szeged 1—24.
FELFÖLDI, L. (1974): A biológiai vízminősítés (Biological waterqualification). — Vízügyi hidrobiológia *3*, Vízdok. Budapest, 1—42.
FRÖMMING, E. (1956): Biologie der Mitteleuropäischen Süsswasserschnecken. — Berlin, 1—313.
GULYÁS, P. (1976): KGST egységes vízvizsgálati módszerek III. Biológiai módszerek (Unique methods of COMECON for aquatic investigations. Biological methods). — VITUKI Budapest 1—250.
HÄSSLEIN, L. (1966): Die Molluskengesellschaften des Bayerischen Waldes und des anliegenden Donautales 20. — Bericht der Natur. Ge. Augsburg. *110*, 1—176.
HORVÁTH, A. (1943): Beiträge zur Kenntnis der Molluskenfauna der Tisza. — Acta Zool. Szeged *2*, 21—32.
HORVÁTH, A. (1955): Die Molluskenfauna der Theiss. — Acta Biol. Szeged I. 174—180.
HORVÁTH, A. (1958): Die malakologischen Ergebnisse der II. Tisza Expedition. — Acta Biol. Szeged *4*, 416—418.
HORVÁTH, A. (1962): Kurzbericht über die Molluskenfauna der zwei Tisza Expeditionen im Jahre 1958. — Opusc. Zool. Bp. *4*, 77—83.
HORVÁTH, A. (1972): Aquatic Mollusca fauna of the flood area and dead arins of the Tisza. — Tiscia (Szeged) *7*, 37—46.
MAYER, A. (1968): Magyarország erdőtársulásai (Forest-associations of Hungary). — Akadémiai Kiadó Bp. 1—155.
ÖKLAND, J. (1979): Distribution of environ mental faktors and fresh-Water snails (Gastropoda) in Norway: Use of European. In wertebrate Surwey principles. — Malacologia *18*, 211—222.
PIECHOCKI, A. (1979): Fauna Slodkowodna Polski 7. Mollusca. Polska Akad. Nauk. Zakled. Biologii Rolnej, Panstwowe Wydawnictwo Naukowe, Warszawa—Poznan 1—187.
PINTÉR, J. (1968): A magyarországi sapkacsigák (Ancylidae) újabb alakjai (The latest forms of Ancylidae in Hungary). — Állattani Közl. *55*, 97—104.
PINTÉR, L. (1974): Katalog der rezenten Kollusken Ungarn Fol. — Hist. nat. Mus. Matr. *2*, 123—148.
PINTÉR, L., RICHNOVSZKY, A., S. SZIGETHY, A. (1979): A magyarországi recens puhatestűek elterjedése (The spreading of the recent mollusks in Hungary). — Soosiana, Supl. *1*, 1—351.
RICHNOVSZKY, A., PINTÉR, L. (1979): A vízicsigák és kagylók (Mollusca) kishatározója (Description of watersnails and shells). — Vízügyi Hidrobiológia *6*, Vízdok. Bp. 1—206.

ROTARIDES, M. (1931): A lösz csigafaunája, összevetve a mai faunával, különös tekintettel a Szeged vidéki löszökre (Snail fauna of the loess compared with the today's fauna, with special regard to loesses of the Szeged area). — A szegedi Alföldkutató Bizottság Könyvtára Állattani Köz. 8.

TÓTH, M., BÁBA, K. (1981): A Tisza és mellékfolyói medrének molluskái. — Tiscia (Szeged) *16*, 183—189.

A Körtvélyesi Tájvédelmi Körzet vízi és szárazföldi puhatestűinek összehasonlító faunisztikai és ökológiai vizsgálata

BÁBA K.

Juhász Gyula Tanárképző Főiskola Biológia Tanszék, Szeged

Kivonat

A szerző 1959—81 között 21 gyűjtőhelyen gyűjtött.

A szárazföldi gyűjtőhelyek fajszegénységét (7 élő faj) két tényező indokolja. Az alacsonyan fekvő ártér miatt az évente 2—3-szor jelentkező áradások átmosó hatása (a diverzitás egyenletesség alacsony értékei ezt jól mutatják), valamint az erdészeti, mezőgazdasági háborítás.

Az őshonos erdőállományok csiga együtteseik összetételüket tekintve megfelelnek a Tisza völgyében másutt talált viszonyoknak (BÁBA 1980b).

A megvilágítás erőssége, az erdőállományok záródása befolyásolja a faj és egyedszám alakulását. (2. táblázat, 2. 3. ábra)

A körtvélyesi holtág állapotának felmérését az egymás után következő növényzeti successiós állapotok csigaegyütteseinek mozaikszerű összeállítása és összehasonlítása képezte. A vízi biotópok puhatestű faunája hasonló más holtágak, kubikok faunájához. A kubikokat Körtvélyesen erdőtelepítéssel kiszárították. A holtág a természetes feltöltődés egy állapotát mutatja. Kultúrhatások kimutathatók az aljzat faunáján (kagylópusztulás). A vegetáció háborítottságát egyes fajok egyedszámának növekedés és más fajok kiesése mutatja.

Uporedni faunistički i ekološki prikaz vodenih i kopnenih mekušaca za tićenog okruga Körtvélyes

BÁBA K.

VPŠ "Juhász Gyula", Katedra za biologiju, Szeged, Hungaria

Abstrakt

Autor je u periodu 1959—1981. godine prikupljao materijal sa 21 lakaliteta. Siromaštvo suvozemnih lokaliteta u vrstama (7 vrsta) odredjuju dva faktora:

— na dvo- i trokratno godišnje ispiranje sa niskih plavnih područja jasno ukazuju niska vrednosti diverziteta, i

— antropogeni uticaj šumarstva i poljoprivrede.

Sastav zajednice puževa u autohtonim šumskim zejednicama odgovara nalazima sa drugih područja duž doline reke Tise (BÁBA 1980b). Na broj vrsta i jedinki utiče intenzitet insolacije i sklop šumske zajednice.

Uporedna naliza mozaičnog rasporeda zajednice puževa na mrtvajama Körtvélyes vršena je na osnovu sukcesija biljnog pokrivača. Fauna mekušaca vodenih biotopa je slična fauni drugih msrtvaha i kubika. Kubici Körtvélyes-a su šumskim plantažama isušeni. Mrtvaja pokazuje stanje prirodnog zasipavanje. Antropogeni uticaj je očigledan na fauni korita (uginuće školjki). Promena vegetacije popraćena je povećavanjem brojnosti pojedinih, odnosno iščezavanjem drugih vrsta.

СРАВНИТЕЛЬНЫЕ ФАУНИСТИЧЕСКИЕ И ЭКОЛОГИЧЕСКИЕ ИССЛЕДОВАНИЯ ВОДНЫХ И НАЗЕМНЫХ МЯГКОТЕЛЫХ КЁРВЕЙЕШСКОЙ ЗАПОВЕДНОЙ ЗОНЫ

К. Баба

Кафедра биологии Пединститута им. Дьюла Юхас

Резюме

Автор проводил исследования с 1959 по 1981 год, в 21 точке. Бедность наземных видов в исследоваемых местах (7 живых видов) обуславливается вдумя причинами. От низкорасположенной заливной територии — влияния промыва, 2—3 в год проходящих наводнений (равномерность низких показателей этого ясно показывает табл. 3), а также из-за лесных и сельскохозяйственных работ. В аборигенных лесных массивах состояние моллюсков соответствует маллюскам обнаруженным в других местах долины реки Тисы (Баба 1980 б).

Сила освещения и сомкнусть древостоя лесов в значительной мере влияют на развитие видов и отдельных популяций.

Определение состояния старицы Кёртвейеш следует искать в очередно следуемых следуемых растительных сукцесионных отношениях и мозаичной структуре мягкотелых. Мягкотелая фауна водных биотопов сходна здесь с фауной других стариц и ям. Однако, при лесоустройственных мероприятиях отдельные ямы у Кёртвейеша были высушены. Старицы однако показывает на свое естественное происхождение. Гибель данной фауны (беззубки) происходит, в основном, от влияния человека. Колебание вегетационного состояния происходит от гибели илиот или от вазвитияотдельных видов растений.

Tiscia (Szeged) Vol. XVII, pp. 191—197 (1982)

ICHTHYOLOGICAL RELATIONS OF KÖRTVÉLYES DEAD-CHANNEL IN MÁRTÉLY LANDSCAPE PROTECTION AREA

Á. FARKAS

Miksa Déri Machine Industrial Secondary School Szeged, Hungary
(Received 15 October, 1981)

Abstract

I have been investigating Körtvélyes dead channel since 1972. A holiday resort was established on the banks of Mártély dead channel, as a consequence of this the ecological conditions of the dead channel have changed.

I shortly introduce my methods of investigation. I mention the plant species and plankton which are important from the point of view of fish fauna. I indicate their significance, the pathogen bacterium flora of the dead channel and the resulted fish-death. I describe the frequent fish species, the quantitative and growth relations of fish stand and alevin. I call attention to the circumstances endangering the fish stand.

I set up fauna list about fish species found in the dead channel in 1976 and 1981. I indicate their frequency. I call attention to the changes in the dead channel wich have happened during this period. I describe the fish species decreasing or increasing in number, in the menatime disappeared or appearing fish species according to their frequency. On the basis of my observations I try to explain the presumable causes of this phenomena.

Introduction

The research of fish fauna the observation of reproductive and growth relations of single species have important economic interest. As a result of foundation of industrial units, application of chemicals artificial fertilizers our rivers and natural waters have become more and more polluted. So the protection of indigenous fauna and flora is absolutely necessary. Our state wish to ensure the achievement of this aims by foundation of landscape protection areas. The third landscape protection area of our country after Tihany and Badacsony, the Mártély landscape protection area can be found on the left bank of river Tisza. Two dead channels take up positions on the landscape protection area: Mártély and Körtvélyes dead channels. Few literary data are available about the fish fauna of dead channels (FARKAS 1976) from this part of river Tisza (FERENCZ 1965, MARIÁN 1971). The Committee of Tisza Research of Hungarian Academy of Sciences deal with the complex investigation of dead channel.

Material and Methods

I investigate into the fish fauna with the help of fishermen trusted with fishing of the dead channel. The fishing is done by laying down of fish-baskets, by curtain-net (so called „marázsa") and binding up angle. The whole dead channel is fished every year twice or three times with trailnet. So I have opportunity to observe both the quantitative formation of fish fauna and the frequency of single species. In addition to this my own fisher-tackle also helps to take a survey of fish fauna. My instruments are: 1.5 m×1.5 m brood-trap, 4 mm×4 mm close-meshed net, fishing tackle and drag-net. I sort the fish caught during the general fishing according to species, I determine their age on the basis of their scale-annual rings then I measure the weight of same aged fish and I calculate their average weight. The totality of caught fish was regarded as 100% from this I established the frequency and percentage amount of single species on the basis of individual number of every single species.

From 1000 pieces caught fish:

+	rarely occuring species	1—5
+ +	less frequent	5—20
+ + +	frequent	20—50
+ + + +	very frequent	50—200

I investigated into the stomach-content of predatory fish only. The fish species being in the stomach were determined on the basis of their scales, fins and pharyngeal teeth.

Description of Körtvélyes Dead Channel

Körtvélyes dead channel is situated on the left bank of river Tisza between 201—203 riverkm-s east of Szeged. Its length is about 5 km its average width is 300—400 m. It is U-shaped, periodically closed dead channel. The depth of the water at the two ends of the dead channel is 0.5 m, while in the middle part 2.5—3 m. It becomes gradually deeper from the two ends towards the middle part. The bed is covered by thick mud-layer wich is thickened annually by the flowing back flood. The subsoil of the dead channel is previous (Andó, Bodrogközy and Marián 1974).

It is periodically closed dead channel. It is flooded by Tisza annually several times. During rainy years we can account with 10—13 floods, during droughty years twice or three times. Regular flood is the so called spring-flood in May or June and the flood taking place because of rains in October—November. During the time of flood the water level is growing with 3—5 m. The dead channel is the former bed of Tisza before regulation. It has an overweir at 201st riverkm. Here the overflow is leaving (Simándy 1978). At the end of the dead channel near the dyke a pumping station can be found wich supplies the rice fields with water, resp. let the drained water get into the dead channel.

Characteristic plant species of the dead channel:

On both banks of the dead channel rich plant vegetation can be found, *Salicetum albo-fragilis* association, as well as *Phragmites communis, Lythrum salicaria, Lythrum virgatum, Potamogeton sp., Trapa natans; Carici-Typhoidetum, Caricetum gracilis, Lythro virgatae-Alopecuretum* (Bodrogközy and Horváth 1977). The maximum of these associations is in June, the minimum is in October. The roots of *Salix* and *Populus* species usually reach the water from the bank. These are very favourable places of roe-laying for *Lucioperca* and *Alburnus* species. *Trapa natans* means hiding place, worms living on its roots and stems mean food source for Cyprinidae species. *Trapa natans* covers the shoals of the dead channel contiguously from May till November. *Abramis brama, Esox lucius* like to lay their roes on the water-covered parts of *Lythrum* and *Potamogeton* species during flood (Farkas 1978).

Plankton-stand: concerning the greatest species- and individualnumbers of zooplankton always Rotatoria species are dominant except April. Protozoa and Entomostraca species can be found in medium species — and individualnumbers (Gál 1977).

List of occuring more important species:

PROTOZOA: *Arcella discoides, Difflugia globulosa, Centropixis aculeata, Vorticella campanulla.*
Rotatoria: *Polyarthra vulgaris, Keratella cochlearis, Brachionus angularis.*
Entomostraca: *Moina recrirostris, Bosmina longirostris-typica.*

Concerning the total individualnumber of zooplankton annually two maximums appear: a bigger in Spring (usually in May) and a smaller in Autumn (mostly in September or October). The formation of individualnumber is significantly influenced by the temperature. The optimal watertemperature is between 15—25 °C. At high waterlevel the number of zooplankton strongly decreases, after the flood is reestblished. In Körtvélyes dead channel beside diatoms Chlorococcales green-algaes occure in great number (KISS 1976).

For young fish the above mentioned formation of zooplankton-number is very favourable because the hatched larvae and young fish find rich food especially Rotatoria in the water. We can explain the quick growth and vitality of hatched fish with this. Reproductive conditions of fish of the dead channel:

As the dead channel is flooded annually several times by Tisza the fish stand is continually changing. From the flooded area fish get into Tisza, or into dead channel, by chance into pits (so-called "kubik") after flowing back of the flood. The first flood usually coincides with the reproductive period of Cyprinidae species and on the flood area in the shallow, easily warming up water the young fish quickly hatch. After the flood young fish find favourable conditions in the dead channel. During Summer this individuals grow stronger, then they get back into Tisza with the Autumn-flood. Consequently from the point of view of fish breeding and as a place of laying roes the role of Körtvélyes dead channel is very important concerning the fish fauna of Tisza (FARKAS 1978).

Factors damaging the fish fauna of the dead channel:

The water-quality of the dead channel according to investigations of M. HEGEDÜS (1981) is "clear" 1st class; obligate faecal bacteria for example faecalis coliform, faecalis streptococcus and species of Salmonella genus very rarely can be found. The number of bacteria-plankton is 1—1 000 000 m³, it increases during floods and decreases in Autumn.

2250. Tiscia I. (276-tól) — Rné (4) X. 23.

The water of the dead channel is polluted by the social sewage-water of surrounded settlements as well as by the the drained waters of rice-fields consisting plant-protecting agents. I have experienced more important fish-death in 1975, then in 1977 in the middle of August. According to investigations of M. HEGEDÜS (1981) the fish death was caused by *Salmonella* and by the polluted water (3rd class) of inflowing channel.

The very active fishing is also a damaging factor of fish stand of the dead channel. During the autumnal general fishing a lot of young fish jam into the close-meshed nets For this reason a great number of fry is perishing During the flowing back of Spring-flood fishermen pull curtain-net ("marázsa") between the two banks of the dead channel in every 50—100 m. During some weeks they totally fish the whole fish stand of the dead channel. We should more thoroughly protect our indigenous fish stand in a landscape protection area.

The role of fish stand in bird- and mammal-fauna:

In Körtvélyes dead channel a peculiar flora, bird-, fish- and mammal-fauna of Europe can be found. At the two ends of the dead channel our water-birds find food. Bird-species feeding in the dead channel: *Egretta alba, Egretta garzetta, Ardea cinerea, Ciconia ciconia, Ciconia nigra, Platalea leucorodia, Anas platyrrhynchos, Nycticorax nycticorax, Pandion haliaetus, Fulica atra, Lutra lutra* and *Ondatra zibethica* also occur in the dead channel. Unfortunately *Lutra lutra* isn't able to settle down there because of the intense fishing (CSIZMADIA 1976, 1980).

Results

I determined 31 fish-species in the dead channel in 1976. In 1981 I experienced changes in the number and frequency of fish-species.

Comparison of fauna-lists from 1976 and 1981 according to cha nges of species-individualnumber

Fauna-list		1976	1981
Acipenseridae	*Acipenser ruthenus* LINNÉ	+	—
Esocidae	*Esox lucius* LINNÉ	+++	++++
Cyprinidae	*Rutilus rutilus*	++++	++++
	Leuciscus cephalus LINNÉ	+	+
	Leuciscus idus LINNÉ	+	+
	Scardinius erythrophthalmus LINNÉ	++	++
	Aspius aspius LINNÉ	+++	++
	Tinca tinca LINNÉ	+	+
	Gobio gobio LINNÉ	+	+
	Barbus barbus LINNÉ	++	—
	Alburnus alburnus LINNÉ	+++	++++
	Blicca bjoerkna LINNÉ	+++	+++
	Abramis brama LINNÉ	++++	+++
	Abramis ballerus LINNÉ	+++	++
	Pelecus cultratus LINNÉ	++	++
	Rhoedeus sericeus amarus BLOCH	+++	++
	Carassius carassius LINNÉ	++++	+
	Carassius auratus gibelio BLOCH	+	++
	Cyprinus carpio m. *hung.* HECKEL	+++	+++
	Cyprinus carpio m. *acuminatus* HECKEL	+++	+++
	Hypothalamichthys molitrix VALENCIENNES	+	+
	Ctenopharyngodon idella VALENCIENNES	+	+
Siluridae	*Silurus glanis* LINNÉ	+	+
Amiuridae	*Amiurus nebulosus* LE SUEUR	++	—
Anquillidae	*Anquilla anquilla* LINNÉ	+	+
Gadidae	*Lota lota* LINNÉ	+	+
Centrarhidae	*Lepomis gibbosus* LINNÉ	+++	++
Perciadae	*Lucioperca lucioperca* LINNÉ	++	++
	Lucioperca volgensis GMELIN	+	+
	Perca fluviatilis LINNÉ	++++	++++
	Acerina cernua LINNÉ	++++	++++
	Acerina Schraetzer LINNÉ	++	++

We can explain the rapid breeding of Esox lucius with the repeated flood in February and March as well as with the increased individualnumber of *Alburnus alburnus* and the unchanged great individualnumber of *Rutilus rutilus*. *Esox lucius* has layed roes during the Spring-flood in February—March in every year from 1977 up to this time. The hatched young fish found good feeding conditions and hiding place in the dead channel their growing parameteres were also very favourable. 12% of total weight of in Autumn fished fish was *Esox lucius*, its average weight was 1200 g/individual at the age of three. The cause of decreasing number of *Barbus barbus* and Aspius aspius probably is the increasing amount of mud in the riverbed because of the long-lasting floods of Tisza. The pebbly bottom is less, where these two species can lay their roes. The roots of willows standing on the banks of the dead channel are very advantageous for laying roes of *Alburnus alburnus*. Here they lay roes in great quantity. The number of *Abramis ballerus, Rhodeus sericeus amarus, Carassius carassius,* shows ever decreasing tendency. I think it is caused by the rapid breeding of food-competitors. *Carassius auratus gibelio* reproduced itself rapidly after 1976. Nowadays its individualnumber shows decreasing tendency, in my opinion it is caused partly by the spread of intense fishing partly by the food-competition of *Abramis* species. *Amiurus nebulosus* probably because of illness nearly totally perished from Tisza and its dead channels. *Ctenophoryngodon idella* has appeared in the dead channel in 1977. In 1978—79 significant part of *Trapa natans* was eated by them. They endanger the existence of indigenous fish fauna. From 1980 their individualnumber has been decreasing. They got into Tisza by chance from fish-ponds during floods. Individuals of *Cyprinus carpio* morpha *hungaricus* were considerably mixed with morpha acuminatus. They prefer to be in the dead channel. The shallow part of the bed overgrown with *Trapa natans* is very favourable for them. The weight of their 4—5 years old individuals reaches 1000—1200 g. In 1975 and 1980 their spawning was very succesful. The great number of *Perca fluviatilis* is attributed to the advantageous ecological environment. It is a fish with very low demand of oxygen. It occurs also on the more shallow places of the dead channel. In its nutrition first of all *Alburnus alburnus* plays role, *Rutilus rutilus* is only 24% of its food. I have got the same result at the investigation of stomachcontent of *Esox lucius* too. The reason of this — in my opinion — that *Rutilus rutilus* is able to hide better. *Lucioperca lucioperca* occured only in lower individualnumber in the dead channel. They are mostly 15—20 cm long individuals. Their growing time is good at the age of three they reach 700—750 g in weight (FARKAS 1980, HARKA 1972).

Literature

BODROGKÖZY, GY. and HORVÁTH, I. (1977): Connection between stock structure and organic matter production in the marshlands of the flood-plain at Körtvélyes. — Summaries of Tisza-research Conference VIII, 8.

CSIZMADIA, GY. (1976): A summary of the data of distribution of the Mammalia living in the flood-plains of the Tisza strech in Hungary. — Summaries of Tisza-research Conference VII, 16.

DOBLER, L.-NÉ and HEGEDÜS, M. (1977): Data on the water quality of the Tisza dead-arms in the region conservation district at Mártély—Sasér. — Summaries of Tisza research Conference VIII.

FARKAS, Á. (1977): Pisces Fauna of the Tisza dead-arm at Körtvélyes. — Tiscia (Szeged) *12,* 101—108.

FARKAS, Á. (1977): Ecological relations of fish stand of Körtvélyes dead-Tisza after the appearing of phytophagous fish. — Timely questions of fish breeding in natural waters in Hungary. — Summaries *4.*

FARKAS, Á. (1977): Experiences of the fish destruction at Körtvélyes; the appearance of the hebivorous fish and the ecological relations of their role. — Summaries of Tisza-research Conference VIII, 10.

FARKAS, Á. (1978): The role played by the dead arms and borrowing pits in the natural prolification of fish in the Tisza. — Summaries of Tisza-research Conference IX, 19.

FARKAS, Á. (1980): The role of predator fish in the fish fauna of Körtvélyes dead channel. — Summaries of Tisza-research Conference XI, 13.

GÁL, D. (1977): Some characteristics of the zooplanton of the Tisza dead-arm at Körtvélyes. — Summaries of Tisza-research Conference VIII, 6.

HARKA, Á. (1972): The composition of fish stand in living Tisza. — Halászat *18,* 22—25.

HEGEDÜS, M. and DOBLER, L.-NÉ (1976): Hydrobiological investigation into dead-arm at Mártély in 1974—1975. — Summaries of Tisza-research Conference VII, 2.

KISS, I. (1976): Comparative algological investigation into the dead arms of the Tisza at Mártély and Körtvélyes. — Summaries of Tisza-research Conference VII, 2.
OLÁH, J. (1975): Analysis of unusually great bacterioplankton accompanying the fish-death in 1975. — Halászat *68*, 89.
SIMÁNDY, B. (1978): The channeling of Tisza and the riverbarrage in Csongrád. — Report on the work-meeting of Tisza Research Committee.

A Mártélyi Tájvédelmi Körzet Körtvélyesi-holtágának ichtiológiai viszonyai

FARKAS Á.

Déri Miksa Gépipari Szakközépiskola
Szeged, Magyarország

Kivonat

A terület holtágainak ilyen irányú kutatásai 1972 óta folynak. Megállapítást nyert: a halfaunája szezonális változását tekintve összefüggés adódott a holtágak mikroflóra és faunösszetételének mennyiségi és minőségi változása között. Hasonló eredmények születtek a patogén baktériumflóra és az időnkénti halpusztulás vonatkozásában is.

Szerző adatokat közöl e vizek halfajainak gyakoriságára, a halivadék mennyiségi és egyednövekedési viszonyaira egyaránt. Elkészült a holtágak halfajok faunalistája is, öt évi vizsgálatainak szintéziseként. Ezáltal nyomon követhetők az időközben eltűnt, vagy megjelent fajok is. Felhívta a figyelmet a halfaunát károsító, így a természetvédelem érdekeit is szolgáló hatásokra, azok elhárítására egyaránt.

Ihtiološke osobenosti mrtvaje Körtvélyes zaštićenog okruga Mártély

FARKAS Á.

Srednja našinska škola "Déri Miksa", Szeged, Hungaria

Abstrakt

Istraživanja su zapo⁵eta u 1972. godini. Utvrdjena je uzajamna uslovljenost izmedju sezonskih promena ihtiofaune i kvalitativnih i kvantitativnih promena =ikroflore i faune mrtvaja. Slični su rezultati i u odnosu na patogene bakterije i povremenog pomora riba.

Prezentovani su podaci o čestoći pojedinih vrsta riba u ovim mrtvajama kao i o uslovima kvantitativnog i pojedinačnog rasta riblje mladji. Kao sinteza petogodišnjih istraživanje izradjen je spisak ihtiofaune mrtvaja. Na osnovu toga moguće je pratiti kako vrste koje su nestale, tako i nove koje su se u medjuvremeno pojavile. Ukazano je i na, za faunu riba, štetne uticaje i otkalnjanje istih, a time i na zaítitu životne sredine.

ИХТИОЛОГИЧЕСКИЕ ОТНОШЕНИЯ СТАРИЦЫ КЁРТВЕЙЕШ МАРТЕЛЬСКОГО ЗАПОВЕДНОГО РАЙОНА

А. Фаркаш
Машиннопромышленная специально-средняя школа им.
Микша Дери, Сегед, Венгрия

Резюме

Исследования на старицах наших рек проводятся с 1972 года. В результате пришли к такому заключению, что в количественных и качественных отношениях здесь образуется взаимная связь между микрофлорой стариц и сложением их ихтиофауны. Подобные результаты возникают также между патогенной бактериальной флорой и сезонной гибельню рыб.

Автор приводит результаты по встречаемости видов рыб в водах, а также о количестве мальков рыб в отношениях их развития. На основании пятилетних исследований был составлен список рыбной фауны этих стариц. В связи с этим можно ознакомиться с ростом и гибелью рыб, а также с причинами приводящими к ущербу рыбной фауны, одновременно с возможностью их устранения, что является интересом охраны природы.

Tiscia (Szeged) Vol. XVII, pp. 199—205 (1982)

FEEDING ECOLOGICAL INVESTIGATIONS IN THE DISTRICT OF THE NATURE CONSERVATION-AREA MÁRTÉLY—KÖRTVÉLYES

L. MAGYAR

Juhász Gyula Teacher's Training College, Szeged, Hungary
(Received 5 October, 1981)

Abstract

We have settled graet tits *(Parus maior* L.*)*, blue titmouses *(Parus caerulues* L.) and tree-sparrows *(Passer montanus* L.*)* with the help of artificial nest-holes in the poplar plantation of the Tisza flood plain in the nature conservation area of Mártély—Körtvélyes (Hungary). We examined the nest building, feeding biological relations of these three species.

We stated that the individuals of the settled species used the most advantageous materials and Arthropods for nest building respectively as food from this surrounding.

All the three species fed their youngs on Noctuid larvae and imagos.

Food of tree-sparrows didn't differ in species only in variety from that of the two titmouses.

Bird settlements with the help of artificial nest-holes served unanimously the decimetion of insect pests in monocultural tree plantations.

Raising of the problem

The face of the earth goes over radical changes under the influence of human activity. In consideration of economical factors being determinant also on nature conservancy areas, there is no other choice for rational, nature enthusiastic specialists as to look for those resolutions — between the limits of our present and future economical development —, wich can effect the nature advantageously to a certain extent.

We choose of the investigation of bird relations of artificial poplar forests upon such considerations near 10 years ago.

Birds are indicators of nature conservation — wrote A. KEVE (1965). They — as the most sensitive seizmographs to environmental changes — indicate only subsequently the deterioration of something irredeemably as the result of human activity with altering their course or with their perishing. Birds and plants form an inseparable connection in the nature. This unambigouos unity is at separated in favour of greater financial income.

More and more intensive plants are imprtovled and these tree types growing quikly and their plant associations can be considered not as forests but as plantations. A poplar plantation grows ready for cutting on a right place during 20 years. Birds aren't able to immigrate into these plantations so speedily. For avoiding this the settlement of artificial nest-holes can be a good solution.

Aims and motivation

We tried to promote the settlement first of all of great tits with the help of artificial nest-holes. We thought, if we can localize great tits with artificial nest-holes, at least for the time of hatching, we can determine the interrelation of this species to the given environment with neck-ringig method made on youngs.

Examined area

We began to settle artificial nest-holes upon the request of the Committee of Hungarian Academy of Sciences at Szeged, in the surrounding of the Tisza reach at Mártély—Körtvélyes. At setting out the first lo nest-holes we could approach

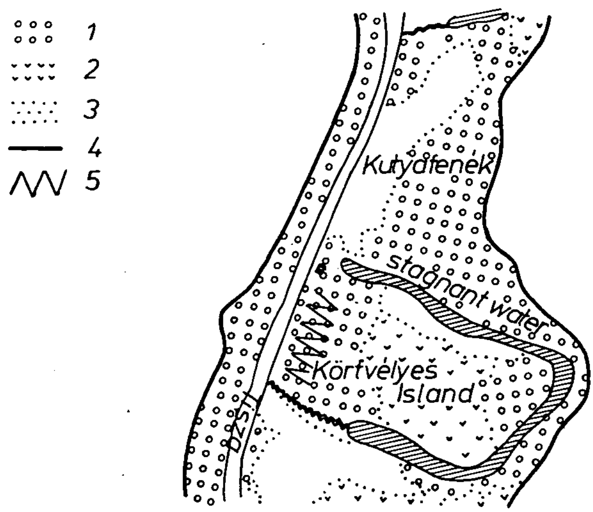


Fig. 1. Examined area in Körtvélyes island: agricultural area; dike; willow-poplar gallery-fore and planted poplar; examined area

the territory only by boat from the side of Vásárhely, because of the high water level in early spring of 1971. At high water only the waterside zone remains dry, so the first and the later nest-holes were also settled parallel to the living Tisza river, on the treetrunks, 100 meters far in the forest, with south-western flying hole. The planted stand consists of poplar respectively of a few maple-leafed platans. The plantation is edged by earth way from the direction of the Tisza. On the side lieing toward the Tisza. On the side lieing toward the Tisza indigenous poplars, willows, Italian poplars and an acacia hedge are grown from the seeds and fruits transported by the water. In the first years only dewberry occured as underwood. Later on — mainly owing to the glades and decimations formed by the thining of tree stands — a nearly impassable thicket of acacia rose. Condition of the ground is damaged also by the current of the river wich beats down the underwood at high waters averagely three times in a year. This was the destiny of the stand planted later on the examined, 1 km long part on the occasion of the high flood in 1970.

The used nest-hole types

I have brought the first hole type from the Ornithological Institute of Hiddensee, ÁDR. This type was modified on the ground of our later experiences. Recently we use holes known from Neschwitz (GDR). Its advantage is, that its closing device

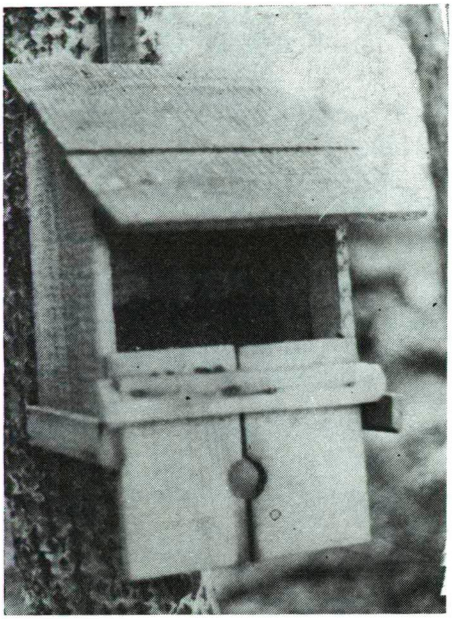


Fig. 2. Nest-hole type from Hiddensee

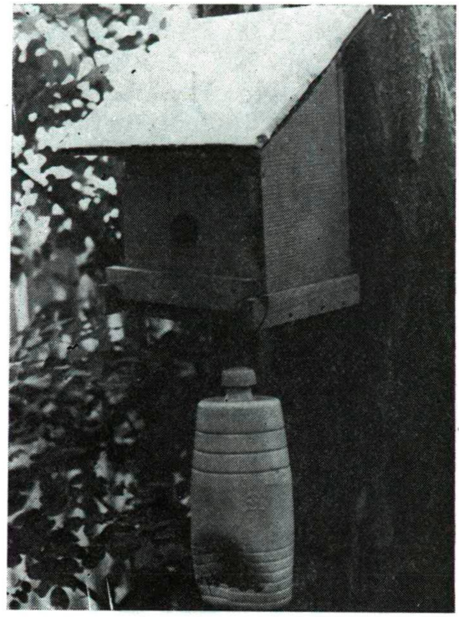


Fig. 3. Tempting feeding on the hole settlement

can not be lifted and carried along by the water at a high water level. For comparison three westgerman facement hole can be found on the territory and also some holes with magnesite basic material made for my suggestions by the Visegrád Parkforest Farm. The usefulness of these holes will be detailed at the discussion of nesting relations.

Periods of investigations

There were monthly hole-visits between 1974—81, and crop-content examinations from May to August. It is characteristic of the examinations' difficulty that during the seven years there were 18 times high water in hatching time. At such a time we could control the holes and take samples only from a boat.

Occupation of holes and nest building

To promote the occupation we used two methods. Partly in favour of winter feeding we put sunflower-seeds in plastic flacons on the nest-holes.

Occupation of new nest-holes was prosperously influenced by the autumnal setting out while recognition of winter hiding-places promoted the rise of nesting number. The next table shows the change in number of holes through nesting time.

The number of holes is decreasing because of the extremely high humidity from year to year. At the beginning we used plastic foil for covering holes. That must be changed in every year. Later we covered the top of holes as well as the upper part of lath with painted aluminium foil, fixing the hole to the tree trunk.

With this method it can be attained to use the holes — made of 2 cm thick deal impregnated with xyladecor — also ten years long. The number of holes was decreased by wilfull damage as well as by the forest thinning works. For this reason 25 holes went wrong during eight years.

Related to holes settled in other forest-types woodpeckers made less damage here. Presumably this rapodly growing tree species, foreign to this land is unfavourable for insects, too. The wood-cement holes with round surface proved to be the best among the settled ones for nesting of great tits. For this reason we fasten compact, triangular logs into the corner of the wooden holes with angular surface.

The sheltered corners of holes are used by different Arthropods for hiding and pupation places from autumn to spring. These Arthropods are: carabid beetles, spiders, caterpillars, their pupas and egg-cocoons. Nest-holes staying empty all the year are settlements for carabid beetles and spiders. The occupied holes are free from intruders. We have placed a biostrip piece into the upper corner inside the hole inaccessible for birds for keeping off pests and intruders. We experienced that owing to this method there can be find no bird-lices, no wooly aphids, no ticks in the nest-holes. Subseguetly youngs can develop better and they become stronger. The above mentioned method is proved also by the bird fanciers' experience of several years.

The nest predator activity of small mammals couldn't be observed in this flood-plain poplar plantation. Probably it is not a favourable hunting-ground for them because of the often water cover wich decreases the number of animals living on and in the ground.

Occupation of nest-holes begins with resting there by night already in winter respectively in early spring. The main hatching time is in the fourth and fifth monthes but hatching pairs can be found rarely still in the seventh month.

Nest building begins with laying the foundation. Mainly moss and fine-stapled grass are used by great tits and they line the nest with deer-hair. Deer-hair has a long, fibrous, tubular structure what seems to be very suitable for liming the nest. This material is plenty available for great tits. Flood of the river affects this fact particularly. The investigated area being nearest to the river-bed is laying the highest. At inundations the part of flood-plain laying nearest to dikes is getting saturated first and so rises the water level on the side of the living river. This is the reason of wild animals' getting stuck in the holm, in the 3 km wide flood plain and their spring-shedding goes on in the district of the hole-settlement. These sloughed hair packs laying all over are used for nest-building by great tits. We tested their quick react to the presence of materials wich can be used for nest building. We experienced that cotton-wool placed out appears in the upper moss layer an hour later.

As it appears from the table 1. at the beginning a lot of tree-sparrows tried to build a nest. Sparrows nesting regularly in couples were collected together and put in linen bags during evening controls and they were taken ten km far away and released there. From such a distance they couldn't return to the hole-settlement. That could be controlled by placeing coloured plastic rings on.

The high flood levels of 1980 lifted and sept away the doors of more holes. In two of the 20 holes wich became opened so, settled redstars. This experience was used for widening the possibilities of nesting. To avoid the endangering of holes by high waters we switched over to Neschwitz hole-type. The hole cover of that can not be lifted by floods.

Table 1. *Number of bird couples hatching in the nest-hole settlement at Körtvélyes during the eight years of the investigations*

Year	Total number of holes in a year	Great tit	Blue tit	Tree sparrow	Total settled holes
1974	45	9	1	1	11
1975	75	16	—	10	26
1976	75	17	1	5	23
1977	70	17	1	5	23
1978	65	16	—	5	21
1979	60	14	1	2	17
1980	56	13	—	3	16
1981	50	12	—	5	17

Neck-ringing method and its results

Food samples can be collected among resident bird youngs by neck-ringing method. Youngs at the age of about 1—2 weeks are the most suitable for this investigation. Rings are made of tin-lead solder wire used in radio-technics since it is enough hexible but rigid at the same time. Youngs remain two hours long ringed when the food samples will be collected one by one with forceps into phials fulled with formalin. Labels are placed in every phial with the right data. Feeding activity was also examined at ringed and not ringed youngs, too, from a suitable distance without disturbing as it is possible. We experienced that feeding activity decreases at ringed youngs. Sulseguently the weight of food samples is less as that of notJringed ones.

Food samples were produced by 290 crop content of 180 nests during eight years. The collected material made possible the determination of 120 insect individuals. (Table 2)

The percentage distribution of insect species found in the collected food samples is as follows:

Lepidoptera	25%	Araneidae	5,5%
Coleoptera	50%	Aphilididae	19,5%

The food consumption in two hours in the case of a young great tit is 370 mg on average in this poplar plantation between May and July. This value is equivalent with seven owlet-moth imagos wich are foraged without wings by the mother birds. The values mentioned above are given on the basis of crop-content samples. We emphasize repeatedly that the feeding intensity is decreasing in holes with youngs. Regrettable no better method is still known for feeding examinations of living birds. Our data are corresponding to the values measured by Rogense, Bouchner, Kluyver (1951) and Manfred (1959). It is remarkable that the two tit species and tree-sparrows feed the same food in this living-space. The intensity of feeding is changing depending on the age of youngs. They get food per minute till the age of one week though food pieces are small. In the age of 2—3 weeks youngs are fed in every fifth, tenth minute. By this time the size of food pieces is equivalent with a wingless imago of Noctuidae or with a Melasoma populi. In the case of plant- louse more specimens are fed at same time. Feeding intensity is the highest after taking flight when the whole tit-family flies from tree to tree. We experienced that bird parents give a food piece to their youngs during this period in every 5—10th second. The food collecting range is the smallest upto the youngs' age of one week, but never surpassed a circle with

Table 2. *Insects determined from the samples*

Parus major (great tit) — *Passer montanus* (tree-sparrow)

results of crop content examinations of their youngs

Group	Developmental stage	Total occurence	Group	Developmental stage	Total occurence
Noctuidae	larva	20	Noctuidae	larva	10
Noctuidae	imago	130			
Melasoma populi	larva	140			
Geometridae	imago	10			
Synaptus filiformis	imago	50	Synaptus filiformis	imago	10
Chrysomelidae	larva	50	Chrysomelidae	larva	40
Dorytomus longimanus	imago	70			
Aphidina	imago	150			
Curculionidea	larva	50			
Salticidae	imago	10			
Araneus	imago	30			
Lepidoptera	larva	10			
Satyridae	pupa	10			

50 meters radius during the time of staying in holes. This can be explained probably with the territory's richness in food. We used traps with ethylenglycol and made collectings with mets for making the identification of food samples easier. The species of food samples in comparision to the collected ones can be found totally convincing.

We were led in the spatial placing of holes — over and above the facts mentioned in the introduction by the next considerations: we placed the holes in groups of 4 respectively of 2 ones, 50—100 meters far from one an other, in the 1 km long and 100 m wide forest belt. The holes were placed one by one at the inner edge of the forest belt. We used a much higher density of holes as KLUYVER (1951) known from the literature. This was suitable for deciding the territory's supporting capacity. Moreover we could solve the problem of feeding in winter with the help of the surplus holes.

Immigration into the holes — except the initial time — was nearly constant and we found it to be 31%. Decrease of this value occured during those years when the holes were swamped by the flood of the Tisza. While during the time of a long lasting flood morl being lower than the level of holes, the number of hatching bird-couples was greater than during the period without inundation. The reason of that is: nests laying near the ground get flooded and therefore increased the occupation of artificial holes.

We found a greater density in the 20 m wide belt of the forest edge as in the zone of 20 to 100 meters. This phenomenon can be called edge-effect which is increasing proportionally with the age of hole-settlement.

During the investigated time period we could meet with an increase of Amorpha fructicosa, acacia stand inside the underwood and on its most dense places a decrease of hatching couples was to be found. We could observe the same at control samplings, too, that is the insect fauna of acacia stand is armer in number of species and individuals. Probably the strong volatile oil of the glandular hairs covering its leaves kepps the insects away. A well recognizable connection can be found between the quality and fauna of forest as living-space. This appears also in this case as from the avicoenological works of LEGÁNY (1968) and others.

References

KEVE, A. (1965): „A madarak a természetvédelem indikátorai" (Birds as indicators of nature conservancy"). — Búvár *2*, 35—38.

KLUYVER, H. M. (1951): The population ecology of the Great Tit, *Parus m. major*. — Ardea *30*, 1—135.

LEGÁNY, A. (1968): Erdőtelepítések madártani jelentősége (Ornithological importance of forest plantations). — Állattani Közl. *55*, 65—73.

Ornito-ökológiai vizsgálatok a Mártélyi Tájvédelmi Körzet térségében

MAGYAR L.

Juhász Gy. Tanárképző Főiskola Szeged, Magyarország

Kivonat

A körtvélyesi tájvédelmi körzet tiszai hullámterében kihelyezett mesterséges fészekoduk segítségével a nemesnyárfa erdőben széncinege — (Parus maxor) telepet hoztunk létre. Fiókáikon ligatúrás módszerrel táplálkozásbiológiai vizsgálatokat végeztünk. Vizsgáltuk ezen kívül a fészek-odútelepen kialakult fészkek sűrűségét, s ezeknek ökológiai okait kerestük.

Megfigyeléseink azt igazolták, hogy az odútelepet nem csupán a széncinegék (Parus mayor) hanem a kékcinegék (Parus coeruleus) és mezei veréd (Passer montanus) betelepedték. Mindhárom faj fiókáin elvégeztük a begytartalom vizsgálatot. A kapott begyminták alapján identifikált rovar-fajok majdnem teljesen megegyeztek.

A három faj által felhasznált rovarok a nemesnyárfa ültetvény legfontosabb kártevői közül kerültek ki. A begymintában e rovarok előfordulásának gyakorisága gradációjukkal egyenes arányt mutatott.

Megállapítottuk, hogy a fészkelő fajok táplálkozására és telepsűrűségére egyaránt hatással volt az aljnövényzet és a lombkoronaszint vegetációja. A gyalogakácos (Amorpha fruticosa) cserjeszintű erdőségben alacsonyabb volt a lakott fészekoduk száma.

A monokulturális erdőben a kártevő rovarok gradációinak csökkentésében a mesterséges fészekodú-kihelyezésével a megtelepített széncinkék hathatós segítséget nyújtottak.

Ornito-ekološka istraživanja na području za ti enog okruga Mártély

MAGYAR L.

VPŠ "Juhász Gyula", Szeged, Hungaria

Abstrakt

U plantažnoj topolovoj šumi na plavnom području Tise, zaštićenog okruga Körtvélyes, uspostavljena je kolonija velike senice *(Parus mayor)* putem postavljenih gnezda. Na ptićima primenom ligature, izučana je biologija ishrane. Registrovano je takodje i gustina naseljenih gnezda u koloniji i traženo njihovo ekološko tumačenje. Utvrdjeno je da je koloniju postavlje-nih gnezda pored velike senice naselila i plava senica *(Parus coeruleus)* i poljski vrabac *(Passer montanus)*.

Determinacijom uzoraka insekatskog materijala u voljci, utvrdjeno je da se ptići ove tri vrste ishranjuju skoro istom hranom. Ove insekatske vrste predstavljaju na jznačajnije štetočine plantažnih topola. Utvrdjena čestoća prisutnosti ovih insekata u uzorcima je u pravoj srazmeri sa njihovom gradacijom.

Utvrdjeno je da je gustina naselja ovih gnezdarica i njihova ishrana u punoj zavisnosti od spratovnosti vegetacije. U sastojini sa prisustvom *Amorpha fruticosa* u spratu šiblja, gnezda su slabije bila naseljena.

U monokulturnim šumama naselje senica u postavljenim gnezdima ima značajnu ulogu u smanjivanju gradacije štetnih insekata.

ОРНИТОЛОГО-ЭКОЛОГИЧЕСКИЕ ИССЛЕДОВАНИЯ В ПРОСТОРЕ ПРИРОДООХОРОННОЙ ЗОНЕ МАРТЕЛЯ

Л. Мадяр
Пединститут им. Дюла Юхас, Сегед, ВНР

Резюме

В Кертвельешской заказнике, в тополевом лесу разливной территории реки Тисы при помощи искусственных дупловых гнезд удалось развести колонии синиц. Над птенцами этих птиц провели исследования их биологического питания. Одновременно провели исследование над причинами вознекновения густоты гнезд и экологические причины их образования.

Нам пришлосб убедится и в том, что колонии гнезд в дуплах заселили не только синица обыкновенная и голубая, то также полевой воробей. Проведено изучение содержимого зоба птенцов. По содержанию насекомых взятые желудочные пробы, были идентичными у всех трех видов птиц. Обнаруженные насекомые в желудках относятся к наиболее важным вредителям тополевых насаждений.

Насекомые в желудочных пробах птиц находятся в прямых отношениях с градиацией их встречаемости.

Определилось также, что на пищу и густоту, колонии гнездующихся птиц, большое влияние оказывал растительный подлесок, а также высота и ширина кроны деревьев.

В кустарниковых лесных ценозах с малым аморфы, дупла меньше были заняты птицами.

В монокультурных лесах, в уменьменной градации вредных насекомых путем размещения дупловых гнезд, население синиц производят значительную помощь.

Tiscia (Szeged) Vol. XVII, pp. 207—218 (1982)

ECOLOGICAL AND QUANTITATIVE RELATIONS OF THE BIRD COMMUNITY IN THE HOLM KÖRTVÉLYES

M. MARIÁN and L. PUSKÁS

(Received 10 October, 1981)

Abstract

The authors made ornithological investigations on one of the typical flood-plains of the Tisza, on the so called Körtvélyes-holm (South Hungary, lower reacses of the river Tisza). They classified the ecosystems of this region in the light of the effects of the most important ecological factors affecting the bird community. They introduce the species living and nesting in the different biotops and regions of the aquatic and terrestrial ecosystems. They discuss the effect of floods on the nesting community and on migration of birds.

Participation of Passeriformes in the energy flow of the territory is demonstrated on the basis of the biomass of bird species.

Introduction

Our study is the prosecution of a systematical examination of bird community living on the flood-plains of the lower Tisza reaches at Tápé, Vesszős, Lakitelek publicated in the years 1965, 1973, 1978.

The land — to which the flood-plain, named Körtvélyes holm belongs — has still maintained some characteristics of the geographical and biological state from before the Tisza's control, therefore it was selected to be a nature conservancy area by the National Nature Conservation Office (1971).

Körtvélyes holm which is enough good protected against antropogenic effects in consequence of the terrain's attributes and the water covering of the frequent, long lasting floods, is the biotop of a typical Tisza flood-plain bird community. Its examination is an important task in the respect of Tisza-research, but its result can be well used for the nature preserve and forestry practice, too.

The first of its examiners was probably K. LAKATOS, who was fowling on this territory in the final years of the last century, then B. BODNÁR collected there. Later on P. BERETZK, I. STERBETZ, M. MARIÁN, A. BANKOVICS, GY. TREASER examined this bird community. (i. BOGDÁN. M. MARIÁN, L. PUSKÁS, L. SALAMON)

The systematical work was carried out by the ornithological group in the frame of the Tisza Research Work-group. Now we should like — beside the environmental effects on bird community — to introduce the quantitative relations of the songbirds (Passeriformes) living there.

Materials and Methods

Körtvélyes holm lays 30 km far from Szeged, to the North. Its surface is about 20 km^2. The horseshoe-shaped territory is surrounded from northern-east by the Tisza reach between 203—204,6 river-km, from the other sides by the Körtvélyes back water. On terrestrial way it can be approached only from the north-western corner (1. scatch map).

The area belonging to the Tisza basin in geological sense was formed by the erosion of the Holocene Tisza. Its highest parts are the river-side sand-hills accompanying the recent stream-bed. The marshy lowlands lieing inside the holm are originated on the place of the mortlakes originated as a consequence of the former river-bed-drag.

The Körtvélyes back-water disconnected from the Tisza in 1887, is connected with the river — only at high waters — by a canal. The water overflow of the surrounding agricultural land polluted sometimes by plant protectives and chemical fertilizers, is lifted into the back-water.

The holm is inundated with 2—3 m high water by the Tisza flood in almost every sring, so it is one of the most important factors of the evolution of ecosystems respectively bird communities.

This ground belongs to the climatic zone with warm, dry and hot summers, of the Lower-Tisza region. The mean annual temperature is 10.5 C. The long, warm autumn is characteristic. Winters are moderately cold, poor in snow. So it becomes possible for the song-birds arriving in flocks from north to overwinter here. The annual precipitation is few, 580 mm.

The half of the plants covering the holm's whole surface consists of soft wood and hard wood forests, respectively paper-poplar plantations. On a smaller and steadily decreasing territory we can find agriculture and orchards suffering from floods (1st scatch-map).

As a method of the research including the whole ground of Körtvélyes holm we used a relative-linear one between 1968 and 1981 (TURCEK 1958).

The quantitative survey of Passeriformes population was carried out on a standard territory of two hectares marked out in the old willow-poplar forest flourishing by the northern reach of Körtvélyes back-water. There we survayed with an absolute quantitative method (MARIÁN, 1979) in every two weeks during hatching time.

There were such years or yearly such periods at the every twoo investigations when we could come nearer to Körtvélyes holm only through the river Tisza by ship and we could move on the territory only with boats.

Results

In the following we examine first of all the effects of the most important ecological factors regulating the vital conditions of nesting species.

Birds as living beings in general get into close connections with their surrounding through the possibilities respectively processes of feeding (food supply), reproduction (nesting places, presence of nest material) defence (hiding places against climatical effects and natural animies, posts for watching the latter).

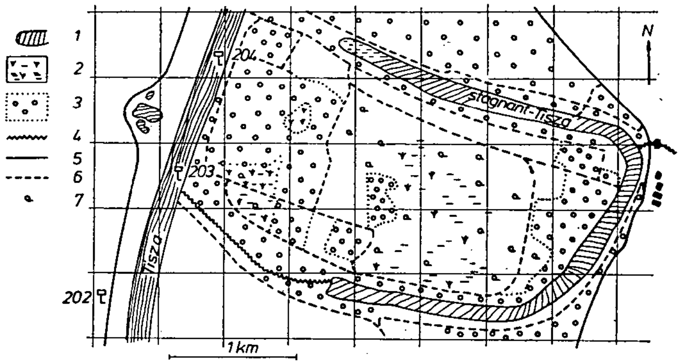
Because of the regular floods — about the ecological effects we shall write later — Körtvélyes is one of the few South-plain territories (of the great Hungarian Plain) where the antropogenic interposition (hunting, tree cutting, soil cultivation tried over again, hay making) is relatively insignificant, not occured in some years. The whole region is practically unpopulated.

Taking all these into consideration and typifying the ecosystems of this region in the intrest of characterisation, we can establish the followings.

Aquatic ecosystems

1. Back-water

On its surface grow the associations of water-chestnut *(Trapetum natantis)* MÜLL. et GÖRS 60 and water-fern *(Salvinio-Spirodeletum)* SLAVN. 56. Its tidal water is lined in many places by rich sedge-association, elsewhere by reed-spots. Its water



Ihetch map. The Mártély holms: 1. backwater, 2. meadow 3. forest 4. caual 5. dam 6. path 7. clump

is refreshed and dammed by the yearly icy and green flood of the river Tisza. As a function of that the water level fluctuates between 2—0.8 meters. The buttom is covered by 50—60 cm deep mud. The water is rich in micro-organisms and fishes. A lot of water and wading birds can find here their food but only few satisfactory hatching places are to be found. Establishment for nesting of birds is disturbed by the anglers being active there.

Characteristic nesting species are: Anas platyrhynchos (this hatches also in hollows and among the top branches of water side willows), *Fulica atra, Podiceps cristatus, Ixobrychus minutus.*

It means an important feeding place for the species *Nycticorax nycticorax, Egretta garzetta, Ardea cinerea* and *Larus ridibundus.*

2. Stagnant waters, pools

These waters entagling the inside of the holm remain some month long after the flood's passing. They dry up regularly only at the end of July, in August, that is they provide a convenient living place just in nesting time for the riparian and swimming birds. In the stagnant waters wide sedgy-rushy associations can be found which turn into marsh-fields.

Its characteristic species feed predominantly on plant food: *Aythya nyroca, Gallinula chloropus* and *Rallus aquaticus.*

The *Anas platyrhynchos* is nesting here on the ground, on the shore of these stagnant pools. *Fulica atra, Aythya ferina* and *Podiceps rufipes* are hatching in a small number.

Our herons (first of all packs of grey herons) and Limicols are gathering in a great number for the food gived by the ebbing, desiccating stagnant waters during the autumnal migration time. Conversely numerous open water surfaces give accomodation for flocks of duck-arts during the spring migration. The scattered accipitral community is represented only by Haliaëtus albicilla appearing from time to time.

Terrestrial ecosystems

1. Fields

The greatest part of the holm is covered by speargrass marsh-fields *(Carici Alopecuretum pratensis* Soó 71). The above mentioned stagnant waters can be fount in this. As an effect of floods it can be described as a moist field in the greatest pard of the growing season. Its annual plant-associations are changing in accordance with the water-cover. In the infrequent years free from flood on a part of the territory is clipping, what decreases the number of species nesting on ground.

The scattered nearly ground poplar groups *(Populus alba)* are characteristic of the Körtvélyes field. These are resting places for buzzards and kestrels flying above the territory.

Vanellus vanellus hatching on the edge of stagnant waters, *Gallinago gallinago, Saxicola rubetra, Embreza calandra* nesting on the grassy part of the higher, drier places are characteristic among terricol species. *Tringa totanus* also lays her eggs on moist fields in wet years.

Larger or smaller packs of molting ducks (Anas platyrhynchos, Aythya nycroca) also can find a hiding place here. A great number of Ciconia nigra come together for autumnal migration. (We observed 180 specimens on 18th of July in 1976.) More hundred Merops apiaster flit gathering for migration above the territory at the end of July, in August.

2. Forest

About the half of the holm is covered by forest. The bank of the river and the back water is edged with willow-poplar gallery forest *(Salicetum albaefragilis* Soó (33) 58). A coppice of dewberry *(Rubus caesius* facies*)* forms its underwood. The old willow stand along the northern reach of the back water is expecially valuable, it insures the establishment of many hollow living birds. A willow-bush stripe *Salicetum triandrae* Soó 34 runs along the bankline of the Tisza-bed. It is the favourite way of small birds during migration.

Extensive poplar plants are with scattered underwood and with a very small bird community inside the territory. Nests — corresponding to the ecotone type — can be found on the edge pf plantations. Smaller hard-tree forest spots *(Quercus robur, Fraxinus pennsylvanica)*. Platanus hispanica stand on one place grow sparsely. The forest rounds and agricultural parts are edged by rapidly spreading *Amorpha fruticosa* stands.

From the terricol species we have to mention *Troglodytes troglodytes* and *Erythacus rubecula. Phasianus colchicus* — the population of that is increased forcefully by placing out, too — lays her eggs in little dips among dewberry tendrils. One characteristic feature of the wet soiled flood plain forest is that the ground-nesting species make their nests sometimes on fallen, moulding trunks, logs *(Luscinia megarhynchos)*.

Among the arbicol, bush-living species *Lanius corrulio* is nesting mainly on willow bushes adjoined the fields, *Hyppolais icterina* in shrubs. The nest of Hyppolais pallida was found in the riverside willow bus by A. Bankovics (Bankovics 1975).

The presence of 15 hollow-living species was stated in tree-trunk level. The most characteristic are Parus maior, and Phoenicurus phoenicurus. Also many Certhya brachydactyla are nesting in cracks of old trees. Athene noctua is the most frequent among owles.

14 species are nesting in the level of leafy crown. Characteristic are *Columba palumbus, Streptopelia turtur, Garrulus glandarius* and *Buteo buteo. Turdus merula* hatches in the lower region, *Corvus cornix* on the highest part of the trees.

In accordance of our former investigations we can state that there can not be observable adaptation to plant species or to plant associations in nestplacing of the flood-plain arbicol species (Marián—Bankovics—Bogdán—Lőrincz 1978).

The Tisza flood appearing regularly in every year, is an important ecological factor in the forming of the Körtvélyes holm's bird community.

Its outstanding and negative result is the relatively small number of terricol species and individuals. The spring-flood makes impossible the nest building of these species, or what more catastrophic is — the late flood liquidate the brood of the already hatching birds. It thins the brush- and trunk-living arbicol species out. Its food decreasing effect throws the number of crown-mesting birds back.

The flood has a positive effect for the migration in years, following great floods as in 1971, or when green-floods retire slowly, as in 1974, wide, shallow lakes take the place of stagnant pool system. These remain during all the growing season. The number of bird species characteristic for the flood plain of the river increases with typical spring species. (*Platalea leucorodia* packs, wandering *Egretta alba* and *Plegadis falcinellus* individuals can appear).

The importance of Körtvélyes holm, this significant bird-lodgeing-place becomes more evident when we take into consideration the juiding role of the Tisza-line in the Middle-European bird migration (MARIÁN 1980).

* * *

The most characteristic species of gallery forests of Hungarian rivers, so that of the flood plain of the river Tisza, belong to the order of sing-birds (Passeriformes). At the same time these species show the greatest fidelity to place, to the biocenosis of flood plain forests. Therefore we made quantitative examinations on the species belonging to this ordo and nesting in the gallery forest. Our aim was to state the role of these birds in the natural production of the territory.

Our investigation was carried out during the time period, on the place and with the methods described in the second chapter.

We estimated the bird community's role in the matter and energy flow of the environment on the basis of their weight (biomass, BALOGH 1958). The mean weight of the species was estimated on the basis of the data of SZÉKESSY (1958), where there was no reference to that, we calculated it no the basis of the publications of HEINROTH, O. u. M. (1924—1931). We calculated their weight from the total mean values of males and femails (Table 1).

Averagely 172 individuals lived on the standard territory during the time of hatching and breeding youngs, with minimal calculations (taking single hatching and the lowest descendent number for basis) in the examined three years. The sum of their weight (descendants counted with their adult weight) is 6.8 kg (Table 1). That is 86 sing birds, in 3.4 kg weight falls to 1 ha of the flood plain forest with similar ecological features on the Körtvélyes holm.

Copared it to the Passeriformes community of Vesszős flood plain forest wich has the similar vegetation but more favourable geological position (MARIÁN—PUSKÁS 1973), we can state that it counts about onethird of that. There fall 240 individuals with 11 kg in weight to 2 ha of forest territory. The willow-poplar forest of Körtvélyes is far from agricultural areas wich mean good feeding places for some species. Perhaps this is the reason of the absence of COLEUS MONEDULA and STURNUS VULGARIS colonies and a great *Passer montanus* population. We have still to think that this bird quantity is characteristic for the flood plain maintaining its near natural conditions. The Vesszős flood area has to thank the bird cumulating effect of the forest-zone extending among the wide treeless agricultural terrain for its greater population.

Table 1

Species	Trophismus	Individuals per 2 ha	Biomass
Oriolus oriolus	C	6	438
Corvus cornix	D	2	984
Garrulus glandarius	D	4	660
Parus maior	D	26	520
Parus caeruleus	C	16	176
Aegithalos caudatus	C	10	90
Certhia brachydactyla	C	6	42
Troglodytes troglodytes	C	4	32
Turdus philomelos	D	2	136
Turdus merula	D	10	880
Phoenicurus phoenicurus	C	4	52
Luscinia megarhynchos	C	8	144
Erithacus rubecula	D	2	32
Hippolais icterina	C	4	56
Hippolais pallida	C	2	28
Sylvia atricapilla	D	6	108
Sylvia curruca	C	4	48
Phylloscopus collybita	C	6	54
Muscicapa striata	C	6	114
Sturnus vulgaris	C	22	1694
Passer montanus	D	16	368
Fringilla coelebs	D	6	126
Total		172	6782

D Diversivores
C Carnivores

We can get a picture about the practical economical value of the sing-bird community of our territory with the classification of species on the ground of their tropical distribution (Table 2).

Table 2.

Trophismus	Numbers of birds		Biomass	
	Individual	%	g	%
Diversivores	74	43	3814	56
Carnivores	98	57	2968	44
Total	172	100	6782	100

Exclusively plant-feeding (Herbivores) that is pest bird species — in human relation, live not on the examined territory. Diversivore and carnivorous species (insectivorous ones are also ranged with carnivorous) occur in much the same percent.

It can be stated that the species ranged with Passeriformes ordo are important not only as a nature values to be preserved but they are siginificant members of the biocenosis of flood plain forests in the respect of forest economy, protection, too. The value of our conclusion is emphasized by the fact, that we haven't made estimations but calculations on the basis of populations' weight approaching well the reality. The whole bird community of Körtvélyes holm is shown on a fauna-picture — indicating the phenological relations, too (Table 3).

Table 3. *Picture of the fauna*

Species		Month 1	2	3	4	5	6	7	8	9	10	11	12
Gavia stellata	W				—						—	—	
Podiceps ruficollis	N				—	—	—	—	—				
Podiceps cristatus	N				—	—	—	—	—	—			
Ardea cinerea	P				—	—	—	—	—	—	—		
Ardea purpurea	P				—	—	—	—	—	—			
Ardeola ralloides	P				—	—	—	—	—				
Egretta alba	R		—	—						—	—		
Egretta garzetta	P			—	—	—	—	—	—	—			
Nycticorax nycticorax	N			—	—	—	—	—	—	—			
Ixobrychus minutus	N					—	—	—	—				
Ciconia ciconia	P				—	—	—	—	—	—			
Ciconia nigra	P							—	—	—			
Plegadis falcinellus	R							—					
Platalea leucorodia	P						—	—	—				
Anser anser	P			—	—								
Anser albifrons	P	—								—	—	—	
Anser fabalis	P	—	—								—	—	—
Anas platyrhynchos	N	—	—	—	—	—	—	—	—	—	—	—	—
Anas querquedula	P			—	—								
Anas crecca	P	—	—	—							—	—	—
Anas acuta	P				—								
Anas penelope	P	—	—							···	···		
Aythya ferina	N				—	—	—	—			—	—	
Aythya nyroca	N				—	—	—	—	—	—			
Bucephala clangula	W	—	—									···	···
Milvus migrans	P					···	···	···	···				
Buteo buteo	N	—	—	—	—	···	···	···	···	—	—	—	—
Buteo lagopus	W	—	—									—	—
Aquila heliaca	R					···	···						
Haliaaetus albicilla	N	—	—	—	—				—			—	
Circus cyaneus	W	—	—									—	—

N Nesting
P Passing migratory
W Winter visitory
R Rarity

Species		Month (1 2 3 4 5 6 7 8 9 10 11 12)
Pandion haliaetus	R	
Falco subbuteo	P	
Falco tinnunculus	N	
Phasianus colchicus	N	
Grus grus	R	
Rallus aquaticus	N	
Gallinula chloropus	N	
Fulica atra	N	
Vanellus vanellus	N	
Numenius arquata	P	
Limosa limosa	P	
Tringa totanus	N	
Tringa stagnatilis	R	
Tringa nebularia	P	
Tringa ochropus	P	
Tringa glareola	P	
Actitis hypoleucos	P	
Gallinago gallinago	N	
Philomachus pugnax	P	
Larus argentatus	P	
Larus ridibundus	P	
Larus minutus	R	
Sterna hirundo	P	
Columba palumbus	N	
Streptopelia turtur	N	
Streptopelia decaocto	N	
Cuculus canorus	N	
Athene noctua	N	
Strix aluco	N	
Asio otus	N	
Asio flammeus	W	
Caprimulgus europaeus	P	
Alcedo atthis	N	

Species		Month											
		1	2	3	4	5	6	7	8	9	10	11	12
Merops apiaster	P								—	—	—		
Upopa epops	N					—	—	—	—	—	—		
Jynx torquilla	N					—	—	—	—	—	—		
Picus viridis	N	—	—	—	—	—	—	—	—	—	—	—	—
Picus canus	P			—	—	···							—
Dryocopus martius	P	—			—								
Dendrocopos maior	N	—	—	—	—	—	—	···	···	···	···	—	—
Dendrocopos syriacus	N			—	—	—							—
Galerida cristata	N	—	—	···	···	···	···	···	···	···	—		
Alauda arvensis	N				—	—	—	—	—	—	—		
Hirundo rustica	N				—	—	—	—	—	—			
Delichon urbica	P				···	···	···	···	···	···			
Riparia riparia	P				—	—	—	—	—	—			
Oriolus oriolus	N				—	—	—	—	—	—			
Corvus cornix	N	—	—	—	—	—	—	—	—	—	—	—	—
Corvus frugilegus	P	—	—	—	—	—	—	—	—	—	—	—	—
Coloeus monedula	N	—	—	—	—	—	—	—	—	—	—	—	—
Pica pica	N	—	—	—	—	—	—	—	—	—	—	—	—
Garrulus glandarius	N	—	—	—	—	—	—	—	—	—	—	—	—
Parus maior	N	—	—	—	—	—	—	—	—	—	—	—	—
Parus caeruleus	N	—	—	—	—	—	—	—	—	—	—	—	—
Aegithalos caudatus	N	—	—	—	—	—	—	—	—	—	—	—	—
Remiz pendulinus	P				···	···	···	···					
Certhia brachydactyla	N	—	—	—	—	—	—	—	—	—	—	—	—
Troglodytes troglodytes	N	—	—	—	—	—	—	—	—	—	—	—	—
Turdus viscivorus	P			—									
Turdus pilaris	W	—	—	—								—	—
Turdus philomelos	N				—	—	—	—					
Turdus merula	N	—	—	—	—	—	—	—	—	—	—	—	—
Saxicola rubetra	N				—	—	—	—	—	—			
Phoenicurus phoenicurus	N				—	—	—	—					
Luscinia megarhynchos	N				—	—	—	—					
Erithacus rubecula	N	···	···	—	—	—	—	—	—	—	—	—	—
Locustella fluviatilis	N				—	—	—						

Species		1	2	3	4	5	6	7	8	9	10	11	12
		Month											
Hippolais icterina	N				—	—	—	—					
Hippolais pallida	N				—	—	—	—					
Sylvia atricapilla	N				—	—	—	—	—	—			
Sylvia communis	P					—	—	—	—	—	—		
Sylvia curruca	N				—	—	—	—	—				
Phylloscopus trochilus	P				—					—	—		
Phylloscopus collybita	P			—	—	—	—	—					
Phylloscopus sibilatrix	P				—								
Regulus regulus	P	—										—	—
Muscicapa striata	P				—				—	—			
Muscicapa albicollis	P				—				···	···			
Anthus pratensis	P			—						—	—		
Anthus trivialis	P			—						···	···		
Motacilla alba	P			—	—	—	—	—	—	—	—		
Motacilla flava	P				···	···				—	—		
Lanius excubitor	W	—	—	—									—
Lanius minor	P					—	—	—	—	—			
Lanius collurio	N					—	—	—	—				
Sturnus vulgaris	N		—	—	—	—	—	—	—	—	—		
Passer montanus	N	—	—	—	—	—	—	—	—	—	—	—	—
Coccothraustes coccoth.	P	—	—									—	—
Chloris chloris	N		—	—	—	—	—	—	—	—	—	—	—
Carduelis carduelis	N	—	—	—	—	—	—	—	—	—	—	—	—
Carduelis spinus	P		—							—	—		
Carduelis cannabina	W	—	—										—
Carduelis flavirostris	W	—											—
Pyrrhula pyrrhula	W	—	—	—								—	—
Fringilla coelebs	N	—	—	—	—	—	—	—	—	—	—	—	—
Fringilla montifring.	W	—	—									—	—
Emberiza citrinella	P		—	—									
Emberiza calandra	N			—	—	—				···	···		
Emberiza schoeniclus	P			—	—								

References

ANDÓ, M., BODROGKÖZY, GY. and MARIÁN, M. (1974): A Mártély—Sasér Tájvédelmi Körzet társadalmi hasznosításának biológiai és természeti földrajzi alapjai. — Kézirat, tanulmányterv. Szegedi Akadémiai Bizottság Könyvtára — (Biological and geographical basis of the social utilization of environmental protection region of Mártély—Sasér — Manuscript, study-plan. Library of the Academic Commity of Szeged).

BALOGH, J. (1953): Grundzüge der zoocönologie — Budapest.

BANKOVICS, A. (1975): Stand der Verbereitung des Blasspötters im 1972 und 1973 der Donau und Theiss entlang. — Aquila *80—81*, 309.

HEINROTH, O. u. M. (1924—1931): Die Vögel Mitteleuropas. — Berlin.

KEVE, A. (1960): Nomeclator avium Hungarie. — Budapest.

KEVE, A. (1962): Das Vogelleben der Mittleren Donau. — Budapest.

LEGÁNY, A. (1971): Data to the ornithological observations near the rivers Bodrog and Tisza. — Tiscia (Szeged) *3*, 93—103.

MARIÁN, M. (1958): Quantitative survey of birdstocks with absolute method. — Puszta *8*, (Tiscia Suppl. *2*,) 2—3.

MARIÁN, M. and PUSKÁS, L. (1973): Quantitative Untersuchung der Singvogelpopulationen (Passeriformes) des Überschwemmungsgebietes des Theiss. — Tiscia (Szeged 71—77.

MARIÁN, M., BANKOVICS, A., BOGDÁN, I. and LŐRINCZ, I. (1978): Some ecological characteristics of the bird stock of Tőserdő. — Tiscia (Szeged) *13*, 141—149.

MARIÁN, M. (1980): Avifauna of the Southern Great Hungarian Plain. — Szeged.

Országos Természetvédelmi Hivatal (1971): A mártélyi és hódmezővásárhelyi Tisza-hullámtér tájvédelmi körzetté nyilvánító határozata (Hungarian Office of Nature Conservation: Decision declearing the flood area of the river Tisza at Mártély and Hódmezővásárhely as a nature conservation area).

STERBETZ, I. (1974): Die Vogelwelt der Reservate des Überschwemmungsgebietes der Theiss bei Hódmezővásárhely. — Aquila 1971—1972, 45—79.

SZÉKESSY, V. (1958): Aves — Madarak — Birds. — Budapest.

TURCEK, F. (1958): Zönologische Arbeitmethoden für Wirbeltiere. In: BALOGH, J.: Lebensgemeinschaften der Landtirre. — Budapest.

Körtvélyes sziget madárállományának ökológiai és mennyiségi viszonyai

MARIÁN M. és PUSKÁS L.

Kivonat

Szerzők 1968—1980 között végeztek ornitológiai kutatást a Tisza egy jellegzetes hullámterén, az úgynevezett Körtvélyes szigeten (Dél-Magyarország, Tisza folyó alsó szakasza). A madárállományra ható legfontosabb ökológiai faktorok hatását figyelembe véve tipizálták e táj „ökoszisztémáit". Bemutatták az aquatilis és terresztrisz ökoszisztémák különböző biotópjaiban azok régióiban élő fészkelő fajokat. Foglalkoznak a folyó árvízeinek a fészkelő állományára és a madárvonulásra gyakorolt hatásával.

A passeriformes állománynak a terület anyag-energia fogalmában való részvételét a madárfajok biomasszája alapján mutatják be.

Ekološki i kvantitativni aspekti ornitofaune ostrva Körtvélyes

MARIÁN M. i PUSKQS L.

Abstrakt

Autori su na specifičnom plavnom području reke Tise, na ostrvu Körtvélyes, vršili ornitološka osmatranja u periodu 1968—1980. godine. Uzimajući u obzir uticaj najznačajnijih ekoloških faktora na ornitofaunu, izvršili su tipiziranje ekosistema datog područja. Prikazali su gnezdarice pojedinih biotopa unutar vodenih i terestičnih ekosistema. Obradjuju uticaj poplava na gneždjenje i seobu ptica.

Analizom biomase pojedinih vrsta Passeriformes ukazuju na njihovo učešće u prometu materije i protoku energije istraživanog područja.

ЭКОЛОГИЧЕСКИ И КОЛИЧЕСТВЕННЫЙ СОСТАВ ПТИЦ НА ОСТРОВЕ КЁРТВЕЙЕШ

М. Мариан и Л. Пушкан

Резюме

Авторы начиная с 1968 по 1980 год проводили орнитологические исследования на поймах реки Тисы — на так называемом острове Кёртвейеш (Южной Венгрии, в нижнем течении реки Тисы). На основании самых главных экологических факторов влияющие на жизнь птиц, — провели типизацию этой «экосистемы» по гнездование птиц в различных биотопах. Знакомились с влиянием разливов рек на гнездование и перелеты птицы.

Запасы воробьиных (Pasiformes) в материально-энергетическом обороте данной территории приводятся на основании биомассы указанных видов.

Tiscia (Tzeged) Vol. XVII, pp. 219—224 (1982)

DIE WIRKUNG DES HOCHWASSERS DER THEISS AUF DIE POPULATION DER MAULWÜRFE (TALPA EUROPAEA LINNÉ 1758) IM INUNDATIONSRAUM BEI KÖRTVÉLYES (UNGARN)

GY. CSIZMAZIA

Biologischer Lehrstuhl der Pädagogischen Hochschule Gyula Juhász,
Szeged, Ungarn

(11. Nov. 1981)

Auszug

Verfasser hat während der Jahre 1970—1974 Untersuchungen über das Verhalten des *Talpa europaea*-Bestandes im Inundationsraum der Grossen Ungarischen Tiefebene bei Körtvélyes zur Zeit der Überschwemmungen angestellt. Die Forschungen erstreckten sich ausser auf den Inundationsraum bei Körtvélyes (Naturschutzgebiet Kreis Mártély) auch auf den umgebenden Schutzdamm. Als einer der wichtigsten die untersuchte Art beeinflussenden ökologischen Faktoren wurde die Wirkung des Hochwassers festgestellt (CSIZMAZIA 1980). Mit Hilfe von Bodenerschliessungen und Fallen gelang es ihm nachzuweisen, dass anlässlich des Hochwassers der Theiss in dem untersuchten Terrain das Leben der Maulwürfe in dem überschwemmten Boden unmöglich ist. Die Tiere flüchten, aber sie graben ihre Gänge nicht tiefer, wie es STERBETZ 1975 mitteilte. Bohrungen und Untersuchungen von Probebodenprofilen beweisen, dass zur Zeit von Überschwemmungen der Schutzwall dem restlichen Maulwurfbestand Zuflucht gewährt. Die Reproduktion erfolgt in unterschiedlichem Tempo in Abhängigkeit von mehreren ökologischen Faktoren.

Einleitung

Die vorliegende Arbeit berichtet über einen Teil der in den terrestrischen Ökosystemen der Körtvélyes-Insel und des Schutzdammes durchgeführten mammologischen Studien. Das Gebiet bildet einen Teil des Landschaftsschutzkreises Mártély. Ein Teil der bei den Fallen-Fängen erhaltenen Ergebnisse wurde bereits veröffentlicht (CSIZMAZIA 1980). Der andere Teil der Daten ist in den Publikationen von STERBETZ (1975), ANDÓ, BODROGKÖZY und MARIÁN (1974) auffindbar. Auch L. HAVRANEK (1961) hatte auf diesem Gebiet kleine Säugetiere gesammelt. Die ökofaunistischen, populationsdynamischen Untersuchungen des Bestandes an kleinen Mammalien am Schutzwall des oberen Theiss-Abschnittes obliegt CSIZMAZIA und PALOTÁS (1978, 1980). Nach der Erschliessung der faunistischen Verhältnisse der im Inundationsraum und am Schutzdamm lebenden Säuger erscheint eine Ausdehnung der ethologischen und zönologischen Forschungen zweckmässig. Das Studium des Verhaltens von Talpa europaea stellt hinsichtlich der Theiss-Forschungen eine wichtige Aufgabe dar, es bietet den Hydro-Ingenieuren eine Hilfe bei den Wasserschutzarbeiten und dient auch der Naturschutz-Praxis.

Untersuchtes Gebiet und Methode

Das unweit von Hódmezővásárhely am linken Ufer der Theiss (zwischen dem 203. und 205. Fluss-km) gelegene Revier ist an der einen Seite vom Fluss und an den anderen hufeisenförmig von dem Körtvélyeser Toten Theissarm umgrenzt. Den wichtigsten Faktor der gegenwärtigen Untersuchungen bildet die Wasserdurchlässigkeit des Unterbodens. Diesbezüglich besteht ein erheblicher Unterschied zwischen dem rechten und dem linken Flussufer. Am Pleistozän-Gelände am rechten Ufer befinden sich unter dem oberflächlichen Lösz wasserundurchlässige Lehmschichten. Am linken Ufer dagegen — so auch bei Körtvélyes — sind vorwiegend wasserdurchlässige Lehmschichten anzutreffen (MIHÁLTZ 1953). Am linken Ufer — an dem diluvialen Terrain — dringen die Hochwassermassen in die Sandschichten unter dem Lösz ein und der Boden wird ganz bis zur Oberfläche völlig durchnässt.

Über die botanischen Verhältnisse des untersuchten Gebietes informiert die Studie von M. ANDÓ, GY. BODROGKÖZY und M. MARIÁN.

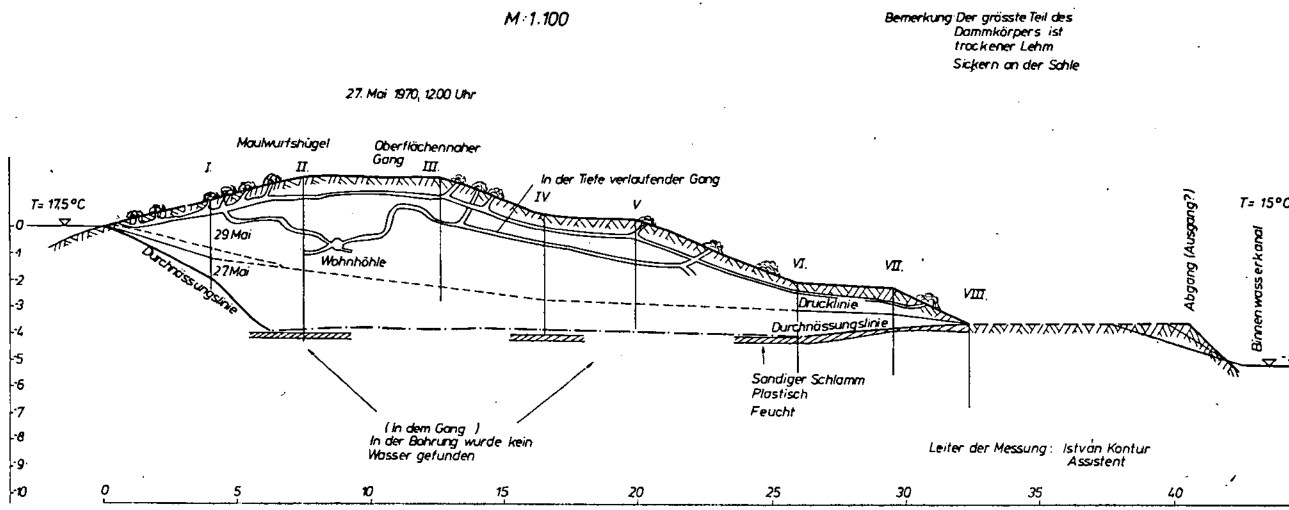
In Verbindung mit den Überschwemmungen im Theiss-Tal ist in der Arbeit von M. ANDÓ und I. VÁGÁS (1972) zu lesen.

Die Erschliessungen und Forschungsbohrungen wurden im Mai und Juni 1970 in Angriff genommen. In den darauffolgenden Jahren hatte ich Gelegenheit, weitere Kontrollgrabungen vorzunehmen. Mit Hilfe der in den Maulwurfsgängen aufgestellten Fallen konnte ich auch die Richtung und das Tempo der Bewegung kontrollieren. Beim Anstieg des Wassers konnte ich — das Terrain mit einem Boot befahrend — zahlreiche weitere Daten sammeln. (Die Anwendung der meinerseits geplanten „Bezeichnungs- und Rückfang-Methode" konnte ich leider nicht verwirklichen.)

Untersuchungsergebnisse

Der Fluss tritt bei einem Wasserstand von 5.5 m (Wasserpegel beim Damm-Wärterhäuschen) über seine Ufer in den Inundationsraum hinaus und erscheint nach Erreichen einer Wasserhöhe von 6.5 m am Fusse des Schutzdammes Dann steigt der Wasserspiegel weiter an und den Inundationsraum können mehrere Meter hohe Wassermassen decken, wie es in den Jahren 1970 und 1974 der Fall war. Meinen Beobachtungen zufolge verlassen dann die Maulwürfe ihre unterirdischen Gänge und flüchten entweder auf der Erdoberfläche oder auch streckenweise schwimmend. Dies beweisen auch die Daaten von STERBETZ (1975), der bei Körtvélyes in den unter einem Nest von Halietus albicilla gesammelten Futterüberresten ein Examplar und unter einem *Milvus migrans*-Nest vier *Talpa europaea*-Individuen vorfand. Auch die Beobachtungen von B. GASKÓ bekräftigen die obige Behauptung. Auf dem von Wasser umgebenen, etwas höher gelegenen Inselchen kommt es dabei zur Anhäufung mehrere Individuen. Viele dieser Tiere fallen Raubvögeln zum Opfer. Im Magen eines Vilpes fand ich am 8. Juni 1969 sieben Maulwürfe. In dem Weidenbau eine Athene noctus (Körtvélyes-Insel) sammelte ich — neben den Jungen — innerhalb einer Woche 15 Exemplare.

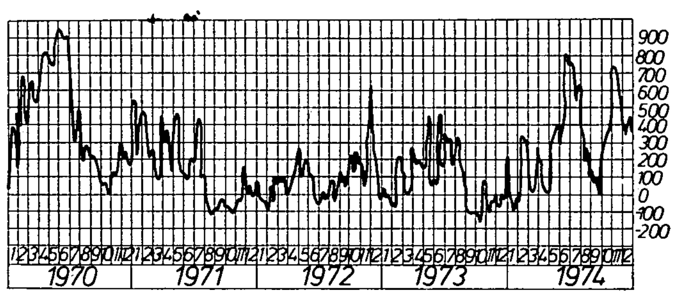
Zur Zeit des Hochwassers erreicht ein Teil der Tiere schwimmend den Schutzdamm, in dessen Körper sie auch Unterschlupf suchen. Die neuangesiedelten Tiere dringen nicht weit ins Innere des Dammes vor, sondern bewegen sich nur nahe der Oberfläche (höchstens 40 cm tief). Drei Exemplare bezeichnete ich mit schnelltrocknender Farbe (am 10. Juni 1974), die ich in den oberflächennahen Gängen zu wiederholten Malen erneut einfing. Interessant ist, dass sich an dieser kleinen Strecke weitere Exemplare weder an der Oberfläche, noch nahe derselben bewegten. Möglicherweise handelt es sich um eine negative ökologische Affinität zwischen den Urbewohnern des Schutzdammes und den neuangesiedelten Tieren. In dem trockenen Lehm des angebohrten Dammkörpers traf ich Maulwurfsgänge auch in 1.5 bis 2 m Tiefe an In der hier placierten Falle fing ich im Zeitraum von drei Wochen insgesamt nur ein einziges Exemplar.



Zeichnung 1. Querschnitt eines Bodenprofils beim Theiss-Pumpwerk bei Körtvélyes (Linkes Flussufer 37+095)

Abbildung 1 veranschaulicht die Zeichnung der in einem Boden-Profil bei der Pumpanlage am linken Theissufer bei Körtvélyes (37+095) freigelegnet Maulwurfgänge. Nach dem Abfluss des Hochwassers habe ich an der Insel Körtvélyes weder *Talpa*-Bewegungen, noch Maulwurfshaufen beobachtet. Anderwärts erfolgt die Regeneration schnell, bereits zwischen den Pfützen, hier aber versperrt der Tote Arm bei Körtvélyes den Weg zum Eindringen. Nur von dem als Barci-rét und Kutyafenék bekannten Gebiet des Inundationsraumes her erreichen die Maulwürfe — unter Umgehung des Toten Flussarmes — die Insel, wozu sie ca. zwei Wochen benötigen. Die an der Körtvélyeser Wiese (rét) unter grossen Schwierigkeiten durchgeführten Bodenaufdeckungen haben eine eindeutige Bestätigung des Gesagten erbracht.

Dem Graphikon der Wasserstandsmessungen der Theiss während der Jahre 1970—1974 (Abbildung 2) ist zu entnehmen, dass 1971 die regenierte Population durch das Hochwasser nicht gelitten hatte und sogar auch in folgenden Jahre nur die Überschwemmung im Dezember gefährlich war. Auch hier sah ich — in geringer Zahl — an der Oberfläche flüchtende Individuen, die aber grossenteils in den kalten Fluten umkamen. Die Regeneration des Bestandes ging om Jahre 1973 langsamer vonstatten, die Population der Insel Körtvélyes blieb gering an Zahl. Vor den Frühjahrsüberschwemmungen und der grünen Flut vermögen die Tiere sich besser zu retten als vor dem winterlichen Hochwasser.



Zeichnung 2. Graphikon der Wasserstände der Theiss während der Jahre 1970—1974 (Direktion der...)

Bei dem 8 Meter hohen Wasserstand Mitte Juni des Jahres 1974 konnte ich wiederum ein erfolgreiches Flüchten der Maulwürfe verzeichnen. Der Inundationsraum besitzt eine hochradige Anziehungskraft für die Talpa europaea-Bestände. Die Rücksiedlung in den Inundationsraum erfolgt aus der vorübergehend am Schutzdamm zur Vermehrung gelangten Population. Dieses saisonale Migrationsphänomen lässt sowohl vom Gesichtspunkte des Hochwasserschutzes, wie auch aus der Sicht des Naturschutzes erhebliche Probleme erstehen, so dass weitere Untersuchungen in dieser Richtung zu den Aufgaben der folgenden Jahre gehören.

* * *

Verfasser hat während der Jahre 1970—1974 im Inundationsraum der Theiss bei Körtvélyes Untersuchungen über das Verhalten der Maulwürfe *(Talpa europaea)* während der Überschwemmungen angestellt. Während STERBETZ (1975) vermutet, dass diese Art sich zur Zeit von Hochwässern tiefer in den Boden des überschwemmten Inundationsgebietes eingräbt und so das Hochwasser überlebt, haben die im Bereich von Körtvélyes angestellten Bodenprofiluntersuchungen, die Fänge und anderwitige Beobachtungen ergeben, dass dies als ausgeschlossen betrachtet werden kann. Die Maulwürfe kommen bei Überschwemmungen an die Oberfläche und trachten sich — oft schwimmend — zu retten. Einem Teil von ihnen gelingt dies und sie suchen Zuflucht im Schutzdamm. Die Regeneration geht nach dem Rücgang der Wassermassen schnell vonstatten, untersteht aber dem weitgehenden Einfluss der ökologischen Gegebenheiten des Inundationsraumes (Umgehung des toten Flussbettes). In Inundationsgebieten mit andere Bodenstruktur (rechtes Flussufer) mag die Vermutung von STERBETZ (1975) zutreffen, doch sind auch in solchen Gebieten eingehende Bodenuntersuchungen erforderlich.

Literatur

ANDÓ, M., BODROGKÖZY, GY. und MARIÁN, M. (1974): Biologische und naturgeographische Grundlagen der gesellschaftlichen Nutzung des Naturschutzgebietes Mártély—Sasér. — Manuscript, Studienplan. Bibliothek des Szegeder Akademischen Komiteés (ungarisch).

ANDÓ, M. und VÁGÁS, I. (1972): Das grosse Hochwasser des Theiss-Tales im Jahre 1970.—Geografische Mitteilungen 1972, *1* (ungarisch).

CSIZMAZIA, GY. (1980): Mammologisch-ökofaunistische Untersuchungen im ungarischen Inundationsraum der Theiss. I. — Wissenschaftl. Mitteilungen der Pädagogischen Hochschule Gyula Juhász, Szeged, 1980 (im Druck) (ungarisch).

CSIZMAZIA, GY. (1981): Untersuchung der kleinen Mammalien an den Hochwasser-Schutzdämmen der Theiss mit besonderer Berücksichtigung der Fragen des Hochwasserschutzes. — Herausgabe der II. Landes-Wandersitzung der Ungarischen Hydrologischen Gesellschaft. Band III.: Hochwasserschutz-Binnenwasserschutz, Pécs, 1981 (ungarisch).

HAVRANEK, L. (1961), Das Leben der Tisza. XVI. Mammalogical investigations in the Tisza basin. — Acta Biol. Szeged, *3—4*.

MIHÁLTZ, I. (1953): Die hydrogeologischen Verhältnisse des südlichen Tisza-Tales vom Gesichtspunkte der Staustufen der Theiss. — Expertengutachten für dass Wasserwirtschafts-Planungsbüro, 1953 (ungarisch).

PALOTÁS, G. (1978): Die Gestaltung der Individuenzahl einiger Nagetiere in unterschiedlichen Futterproduktionsgebieten (ungarisch). — Agrarwissenschaftliche Universität Debrecen. Landwirtschafts-wissenschaftliche Tagung jenseits der Theiss „Tessedik Sámuel", Debrecen, 1978.

PALOTÁS, G. (1980): Untersuchung des Zusammenhanges zwischen dem Populationsdynamismus einiger schädlicher Nagetiere und den Witterungsfaktoren in Hortobágy (ungarisch). — Wissenschaftliche Mitteilungen der Agrarwissenschaftlichen Universität Debrecen *21*, 257—305.

STERBETZ, I. (1975): Ein Beitrag zur Mammalien- und Fischfauna des Naturschutzgebietes Mártély. — Zoologische Mitteilungen 62, *1—2* 1975.

Árhullámok hatása a Körtvélyesi árterület vakondok (Talpa europaea Linné, 1758) populációjára

CSIZMAZIA GY.

Juhász Gyula Tanárképző Főiskola Biológia Tanszék
Szeged, Magyarország

A szerző 1970—74. évek között a Körtvélyesi árterületen vizsgálta a Talpa europaea viselkedési szokásait árhullámok alkalmával. STERBETZ (1975) feltételezése és közlése szerint, e faj árvizek esetén a vízzel borított árterületen mélyebbre ássa magát és ott átvészeli az árhullámot. A Körtvélyesi területen végzett szelvényfeltáró (gát), csapdázó és megfigyelési adatok összevetése után ez kizártnak tekintendő. A Talpák az árvizek alkalmával felszínre jönnek és így próbálnak — sokszor úszva — menekülni. Egy részüknek sikerül, ezek a védtöltésen huzódnak meg. A Talpák regenerációja az árhullám visszahúzódása után gyorsan történik, (hidrofil faj) de az árterület ökológiai adottságai ezt nagyban befolyásolják (holtmeder megkerülése). Más talajszerkezettel rendelkező árterületen (mint pl. a szembenlevő jobb part), esetleg nem kizárt STERBEZT feltételezése, de a feltáró vizsgálatok végzése ott is elengedhetetlenül szükséges.

Uticaj poplava na populaciju krtice (Talpa europaea L., 1758) na plavnom podru ju Körtvélyes

CSIZMAZIA GY.

VPŠ "Juhász Gyula", Katedra za biologiju, Szeged, Hungaria

Abstrakt

Autor je proučavanje ponašanja krtice na plavnom području Körtvélyes prilikom poplava vršio u periodu 1970—74. godine. STERBETZ (1975) pretpostavlja da se krtice na poplavljenom području dublje ukopaju i na taj način prežive poplavu. Na osnovu naših posmatranja i ispitivanja nasipa i ulova i uporedjivanja dobijenih podataka sa područja Körtvélyes, je ova pretpostavka isklučena. Krtice prilikom poplave izlaze na površinu — i često plivajući — se spašavaju. Neki se od njih zadržavaju odbrandbenim nasipima.

Regeneracija krtica se nakom povlačenja vode brzo uspostavlja (hidrofilna vrsta). Proces regeneracije je u velikoj meri ovisna od ekoloških osobenosti samog terena (uaobilaženje mrtvaja). Na plavnim područjima sa drugačijim strukturalnim odlikama tla (kao što je slučaj sa naspramnom desnom obalom) možda nije isključena pretpostavka STERBETZ-a, mada su u tom pravcu neophodna podrobnija istraživanja.

Tiscia (Szeged) Vol. XVII, pp. 225—229

A REPORT ON THE RESULTS OF THE TISZA-RESEARCH WORK IN 1980

GY. CSIZMAZIA

(Received September 22, 1981)

The present-day scene of our 12th Conference may perhaps be unaccustomed to those who were already accustomed to that, in the Aprils of the past eleven years, our scientific lectures were delivered in the Assembly Hall of the Clubhouse of the Academy Committee in Szeged. I think that — on the 12th occasion — we find also here familiar surroundings for our conference and, apart from this even symbolically considerable site, we shall really experience, at present and in the future, as well, the realization of the thematic and intellectual connection between water conservancy and Tisza-research work.

The Tisza-Research Working Committee was always active — since it was organized by Academician GÁBOR KOLOSVÁRY in 1957 — and in 1980, its 23rd year, as well, within the framework of the subject, confirmed by the Hungarian Academy of Sciences and entitled: "complex investigation into the river Tisza and its flood-plain, taking into consideration the river barrages and nature conservary districts", connected with the long-range theme pf the Hungarian Academy of Sciences for 15 years, entitled: "Protection of the man and his natural environment".
tély nature reserve (island Körtvélyes). Our co-workers made, of course, samplings and investigations in the Upper Tisza and in other Tisza reaches, as well. Let us survey, in short, the results of the single fields of work on the basis of reports reveived. It is to be noted that there were one or two co-workers omitting to send in end-of-year reports.

The most important task of water-chemists was to evaluate the full investigation into the sediment-samples from the longitudinal sections and to prepare these for being published. They followed with attention the formation of the water quality of the Kisköre reservoir, after the rinsing canals being opened.

Apart from continuing the bacteriological research into the Tisza, the investigation also covered a few minor afflents (Zagyva, Eger, the brooklet Laskó, the watershed area of the Gerje). It is a monitory result of the investigation that the Tisza shows at Csongrád a 3rd degree pollution, on the basis of bacteriological research works.

The algological water samples are under being elaborated from the reaches of Tisza III. It is indicated by the algological investigations into the brooks Eger and Laskó that the taxons that are characteristic of the waters of such types are strongly selected after the area of the source and the organims indicating pollutions came into prominence. The presence of 130 al4al species was demonstrated by the research work continued for ten years in the Eastern Main Channel — and during the same period, the eutrophication of the Main Channel decreased by 30—35 p.c. By the sewage-filtering systems of the Tisza chemical cobmine a waste water of more favourable quality was admitted into the Tisza in 1980.

The zooplankton investigations included taxonomical-ecological research into the zooplankton to be found in the back-waters between Tiszazug and Szeged. The Bentos-investigation evaluated the sediment samples of the previous longitudinal section of the Tisza, classifying them into oligochaetous and polychatous-groups. In the samples collected in the Kisköre reservoir, larvae of chironomidae live in an anaerobic, muddy organic sediment in a decreasing number. In the hair-weed vegetation, the species ortokladinae which play the part of essential fish foods, multiply.

A group of botanists from Nyíregyháza thoroughly prepared the phytocoenological investigations in their test-area, chosen at Upper Tiszavidék. The microbiological research-work began, in order to recognze reducent organisms, living in the water of the Tisza and reducing hydrate of carbon to its components.

From among the botanical investigations, it is to be emphasized that the aquatic species Alisma plantago is suitable for indicating copper pollution.

From among the zoological investigations, the following are to be mentioned: The ecofaunistic investigations into wild bee populations, continued in the district of the Kisköre reservoir for five years, are terminated. The research into the long-horned beetles (Cerambycidae family) is similarly summarized. The first simulation models about the ant populations of various ecological situations and their regeneration are made. Their proving was postponed to this year owing to the high flood in 1980. The collections of the orders Ortoptera, Neuroptera, Odonata, Ephemeroptera, Trichoptera of the Alpár basin. The collection and elaboration of the Diptera stock of the island Körtvélyes made considerable progress, as well, last year. The elaboration of the mollusc material, collected in all the Hungarian reaches of the Tisza, took place. The ichthyological work was direkted to the spawning of fish and to the problem of returning the brood back to the river. An interesting fact is the fishing out of sturgeon at Tiszafüred.

The group of ornithologists investigated into the productive biological role of the avifauna in the basin at Alpár. In the Middle- and Lower-Tisza Regions the bird-stock-takings and the sonographic analysis of their singing and that of the ethology of certain taxons continued. In 1980, the ekofaunistic evaluation and published. A histological research work was continued into certain species of the ordo of ordinata and the haematocytes of fish in the Tisza.

The number of the co-workers of the Tisza-Research Working Committe was 49 at the end of the year 1980. Foreign co-workers are not included in this number. After acting as secretary for 12 years, Miklós Marián resigned his secretarial post. Instead of him, I have got commission to perform these duties. Here in this Conference, as well, we should like to record our gratitude to Miklós Marián for his activity with which he served the object of Tisza Research in the interest of our common work.

Last year deceased Zoltán Jósa, reader of the Teachers' Training College in Szeged. With his protistological research work he assisted the programme of Tisza research work with success, in the series of long years. Our co-worker was qualified for a candidate's degree, Júlia Széll obtained the degree of doctor in the University. More than one of our co-workers are immediately before btain ing these. The occupational distribution of the Research Working Committee is as follows: natural geometry 1, water chemistry 2, hydrobiology 13, botany 8, zoology 23 co-workers. There have more accessions to our Working Committee. Thus colleagues SÁNDOR BAGDI, ATTILA ZSIGA, ISTVÁN SZEKERES, TICOR KERESZTES, SÁNDOR KOVÁCS, and ZSIGMOND RÉTHY became members. In the recent months, the requents for admission of more other researchers arrived, as well, about which the following session of the Working Committee will decide.

During the year, 1980, 50 papers were written by our co-workers on subjects of Tisza research work. The papers (published 26, in the press 24) were written for the volumes of the Tiscia, Vízdok, (Water Doc.), Acta Debrecina; Acta biologica, Szeged; Főiskola Tudományos Közleményei (Scientific Publications of the Teachers' Training College, Seeged), Annals of the Ferenc Móta Museum, Avifauna of the Southern Great Hungarian Plain, Haliotis and the Hortobágy. There were, also, a few popularizing papers published (Halászat — Fishing), Délmagyarország — Southern Hungary).

Our 23 co-workers delivered 46 lessons on subjects of Tisza research work, in different towns in Hungary and abroad.

These were delivered in the following programmes:

Tisza Research Conference, Szeged; VITUKI, Budapest; County Council, Eger; Meeting of Hydrobiologists, Hajdúszoboszló; "METESZ", Szeged; Hydrobiological Days, Tihany; Kisköre Laboratory, Kisköre; Month of the Museum, Szeged; Meeting of snail researchers, Barcs; Teachers' Training College, Nyíregyházal Itenerary Congress of the Hungarian Biological Society, Kecskemét; Ecologica; Institute of the Polish Scientific Academy, Warsaw; XIIth Malacological Congress, Perpignon.

The library of the Tisza-Research Working Committee highly increased in 1980, as well, by means of the material received in exchange for the Journal Tiscia. It already grew out of its storage place in the small room of the Botanical Gardens. It takes place among the plans of the future, to solve, organize lending out of this important special material for our co-workers.

It is to be said in outlines of the tasks of the present year and of the future ones that our research work should be centralized to the area to be Tisza III and thed Tisza II reservoir. The omitted investigations at Körtvélyes and their synthesis shoul possibly be performed this year.

In the Upper-Tisza, the Research Working Committee of Nyíregyháza perform their work together with those from Ungvár and, similarly, in the southern reaches, the research work is carried out under the auidance of the Departments of the University in Novi Sad (Újvidék).

According to the custims, consolidated so far, the base buildings are at the disposal of our members after stock-taking. We have hopes, as well, of getting to use the research house at the skirts of the bird reserve at Pály. From among the boats, this year the small "sand martin" is in work in hand of Miklós Marián.

We ask our co-wokers to present the inventorized tools and instruments in their use in the month of May, on the days indicated in the letter. After signing the acknowledgments of receipt, these remain, of course, in the use of the co-workers, in the service of the research work.

The Rules of Organization of the Tisza-Research Working Company are ready. The dean of the Faculty of Science of the Attila József Unoversity has entr„sted the presidentin-service of the Biological Committee with supervising it. The ·Hungarian Academy of Sciences and the Centre of Water Supply Management continue moral and material assistance, in the following years, as well.

The Ministry of Education — after a working-place discussion, directed by Comrade Páris — approved pf the Tisza-Research work in 1980 and both the Ministry and the opponenets spoke recognizingly about the research work, of the members of the Research-Working Committee-

The Ministry of Education inviting competition, the Tisza-Research Working Committee entered the competition for a grant on the basis of the concrete research programme. The Ministry decides on the competition and will send a message of it in August. It is to be noted that a very high number of participants take part in the competition. Nevertheless, we have some hope of winning it and, in this case, the financial sources will ppen in September. Till then, we should work under very difficult material conditions.

This month, the meeting of the Zoological Committee was in Szeged, in the Department of Professor MÓCZÁR, where Professor TIGYI, president of the Biological Division of the Hungarian Academy of Sciences and Academician ZOLTÁN KASZAB, President of the Section, confirmed the general reseach direction of the Tisza-Research Working Committee and both the Academy and the Zoological Committee assured our work of their assistence.

We should like to call the attention to a factor, which is very important from the point of view of the future: universities, colleges, laboratories, ought to tryh taking care of educating the young rising generation, dealing with Tisza-researcg work, as well, in order that the gaps, manifesting themselves in certain workin scopes and taxons, should not mean any problem in the following years.

After this short information, restricted to the most important facts, I feel my duty to acknowledge with thanks the great assistence of the competent members of the Water Conservany of the Lawer-Tisza Region, in preading the invitation card of the Conference and placing the big hall at our disposal. Many thanks for these.

I ask my dear co-workers, every member of the Tisza-Research Working Committee, to turn to our Commirree, during their works of this year anf the coming ones, with their requests, problems, plans. We have to continue according to our aommon notions these main research works, characterizing our research working croup. We should endeavour that our existing subjects should not become ossified, certain traditions in the bad sense. The promoter of the research work should not be self-preservation but the connection with real claims, the solution of the tasks given by the inner development of science. I am convinced that with the enthusiastic hard work, being in the past, too, devoted to duty, unselfish and willing to make sacrifices, we shall succeed in uncovering still more exactly the life, living world o our everlastingly beautiful, continuously changing, dear old river, the Tisza.

Árhullámok hatása a Körtvélyesi árterület vakondok (Talpa europaea Linné, 1758) populációjára

CSIZMADIA GY.

Juhász Gyula Tanárképző Főiskola Biologia Tanszék
Szeged, Magyarország

A szerző 1970—74. évek között a Körtvélyesi árterületen vizsgálta a Talpa europaea viselkedési szokásait árhullámok alkalmával. STERBETZ (1975) feltételezése és közlése szerint, e faj árvizek esetén a vízzel borított árterületen mélyebbre ássa magát és ott átvészeli az árhullámot A Körtvélyesi területen végzett szelvényfeltáró (gát), csapdázó és megfigyelési adatok összevetése után ez kizártnak tekintendő. A Talpák az árvizek alkalmával felszínre jönnek és így próbálnak —sokszor úszva — menekülni. Egy részüknek sikerül, ezek a védtöltésen húzódnak meg. A Talpák regenerációja az árhullám visszahúzódása után gyorsan történik, (hidrofil faj) de az árterület ökológiai adottságai ezt nagyban befolyásolják (holtmeder megkerülése). Más talajszerkezettel rendelkező árterületen (mint pl. a szembenlevő jobb part), esetleg nem kizárt STERBEZT feltételezése, de a feltáró vizsgálatok végzése ott is elengedhetetlenül szükséges.

Uticaj poplava na populaciju krtice (Talpa europaea L., 1758) na plavnom podru ju Körtvélyes

CSIZMADIA GY.

VPŠ "Juhász", Gyula Katedra za biologiju, Szeged, Hungária

Abstrakt

Autor je proučavanje ponašanja krtice na plavnom području Körtvélyes prilikom poplava vršio u periodu 1970—74. godine. STERBETZ (1975) pretpostavlja da se krtice na poplavljenom području duble ukopaju i na taj način prežive poplavu. Na osnovu naših posmatranja i ispitivanja nasipa i ulova i uporedjivanja dobijenih podataka sa područja Körtvélyes, je ova pretpostavka isključena. Krtice prilikom poplave izlaze na površinu — i često plivajući — se spašavaju. Neki se od njih zadržavaju odbrandbenim nasipima.

Regeneracija krtica se nakom povlačenja vode brzo uspostavlja (hidrofilna vrsta). Proces regeneracije je u velikoj meri ovisna od ekoloških osobenosti samog terena (uaobilaženje mrtvaja). Na plavnim područjima sa drugačijim strukturalnim odlikama tla (kao što je slučaj sa naspramnom desnom obalom) modža nije iskljućena pretpostavka STERBETZ-a, mada su u tom pravcu neophodna podrobnija istraživanja.

ВЛИЯНИЕ НАВОДНЕНИЙ НА ПОПУЛЯЦИИ КРОТА В ЗАЛИВНОЙ ТЕРРИТОРИИ КЁРТВЕЙЕШ

Д. Чизмазиа

Кафедра биологии. Пединститут им. Дюла Юхас, Сегед

Резюме

Автор с 1970 по 1974 год знакомился с поведением крота во время наворнения на заливной территории Кёртвейем. По данным Штерберта (1975 г.), во время наводнения, крот глубже зарывается в почву и там пережидает наводнение. По проведенным нам исследований, это явление исключается на территории Кёртвейеш. Здесь во время наводнения кроты выходили на поверхность почвы уплывали спасая свою жизнь. Отчасти даже оставались на защитных дамбах. После наводнения рек регенерация кротов проходит очень быстро (гидрофильный вид), несмотря на то, что существующие экологические условия заливных территорий сильно затрудняют этот Нроцесс. Может быть данные Штерберта являются верными иной структуре почвы (на другом берегу реки), однако, в таком случае следует провести разведовательные исследования.

Felelős kiadó: dr. Bodrogközy György
82-2250 — Szegedi Nyomda
Felelős vezető: Dobó József igazgató